The American Quarterly of Roentgenology

Editor, P. M. Hickey, M. D., Detroit
Associate Editor, F. C. Zapffe, M. D., Chicago

Vol. III MARCH, 1912 No. 4

THE GASTRIC MOTOR PHENOMENA DEMONSTRATED WITH THE PROJECTING KINETOSCOPE

BY LEWIS GREGORY COLE, M. D., NEW YORK

Early last spring, through the invitation of Dr. Wm. G. Lyle, I had the pleasure of seeing the Roentgencinematographic films which had been made by Rosenthal, projected on the screen. These films were later reproduced to illustrate an article by Kaestle, Rieder and Rosenthal, entitled, "Bioroentgenography of the Internal Organs," published in the Archives of the Roentgen Ray, June, 1910. An immense amount of credit is due these men for accomplishing a feat, which a few years ago, seemed visionary to the most ardent radiologists.

In the first paragraph of this article, the authors justly called attention to the fact that a true cinematographic reproduction of the movements of an organ is made up of a series of radiograms taken of successive phases of a single cycle, and that when the successive phases are made up of different cycles, no logical claim should be made to the term "Roentgencinematography." Later in their article, they stated that twelve of the radiograms were made during a single respiratory phase of twenty-two seconds, which, they say, is the normal duration of a single peristaltic contraction.

Note—Dr. Cole's paper was read Oct. 1910, and represented work accomplished before that time but did not appear in the last number of the Quarterly owing to the fact that the illustrations which accompany it were mislaid in the turmoil incident to moving of the printers to their new quarters.

The term single peristaltic contraction of the stomach is so new that it may be well to consider its meaning. I believe it should be applied to the formation and duration of a single antrum or the terminal wave. And it seems to me that a better term would be "single peristaltic cycle." We should be careful not to confuse this with the progression of a contraction from its origin near the fundus to its termination at the pylorus.

While the duration of a peristaltic cycle (as above described) varies within wide limits, the average duration is not over two or three seconds. My statement for this is based on repeated fluoroscopic examination and a few double exposures on a single plate, making two exposures of one-tenth of a second each about one-fourth of a second apart. These plates show that the peristaltic contraction travels along the greater curvature about one-fourth inch in one-fourth of a second, or at the rate of an inch per second. Therefore, the duration of a single peristaltic cycle as described above, does not exceed two or three seconds; and the time it takes any individual contraction to pass from the fundus to the pylorus is not over ten seconds. I shall lay no claim to the term "Roentgencinematography" until I have succeeded in obtaining at least four radiograms per second.

After seeing the wonderful set of radiograms made by Rosenthal, projected on the screen, I realized the scope of this method of diagnosis and went to work immediately to produce it. No information whatever was then available concerning his technique, etc., whether an intensifying screen was used or what sort of plate changing device was adopted. My first efforts were without a screen, with a double coated sigma plate, making one-half second exposures. This was too long in the majority of cases, to obtain the necessary detail. With one-fourth second exposures, while we obtained a faint image of the stomach, the plates lacked sufficient density for reproduction. At about this time my attention was called to the calcium tungsten screen which proved to be the most

important of all the factors that culminated in the production of this type of radiograms. Provided it be properly dusted, this screen shows so little grain that the only way its use can be detected is by a slight blur in the bony structure. The density of the plate thus became increased from ten to twenty times, and the fact that it allows the use of a soft tube accounts for the increased contrast in these plates. Not being able at that time to obtain any information concerning the plate-changing device which was used by Rosenthal, I designed the principal parts of two plate and film changing devices. One of these very closely resembles the one later described by Kaestle, Rieder and Rosenthal, and the other I will demonstrate to the Society.*

Technique:—The preparation of the patient is similar to that for an ordinary radiogram of the stomach. The clothing of the patient, who comes in the fasting condition, is removed from the abdomen, and markers are placed over the umbilicus and ensiform process. Two glasses of buttermilk and two ounces of bismuth subcarbonate are then given by mouth. The patient lies, or stands, with the abdomen flat against the opening of the box, and by fluoroscopic examination the stomach is centered so that it is over the opening in the box. The tube, preferably a seasoned one, having a focal point one-eighth inch in diameter, backing up a four-inch parallel spark, without requiring regulation, is arranged about twenty inches from the film and diaphragmed so that it just covers the opening in the box. Exposures of about one-tenth second are made, passing from 40 to 50 M. A. through the tube. During the intervening nine-tenths second, between this and the next exposure, the film is changed as described above. A fluoroscopic examination can be made during the time all these exposures are under way. The films are then developed on a rack, similar to the method used for the regular cinematographic films. The regular cinematographic exposures are then made of these films, care being taken

*Note—I am indebted to Dr. Harry Waite for material assistance in the designing and construction of this apparatus.

to have them centered according to the disks, which appear as markers. About two or three cinematographic exposures are then made of each film. This gives a duration to the peristaltic contraction which corresponds approximately to the actual duration of the contraction, but unfortunately, in the films I have to demonstrate, the radiograms were not sufficiently numerous to give a perfectly smooth appearance to the contractions.

In order to understand the peristaltic contraction of the stomach as observed in a series of instantaneous radiograms, it might be well to have some conception of a fairly normal contraction before investigating the abnormal. Mindful of the chaos, however, which has existed in the minds of physicians in general, and radiologists in particular, since Rieder gave his first bismuth meal and proved that the majority of stomachs do not lie in the abdomen in the old text-book fashion, I hesitate at the mere mention of normal peristaltic contraction. The description of the normal peristaltic wave was avoided by Kaestle, Rieder and Rosenthal, who refer in their article to the peristaltic contraction of abnormal stomach. This is a perfectly fair statement, because the girl whom they radiographed undoubtedly had a normal stomach. But in view of the variation in size, shape and position of the stomachs that functionate in a normal manner, so far as can be determined by all other methods of examination combined, the peristaltic contractions of these stomachs may be assumed to vary in even wider limits with the quantity and quality of the food and the mental condition of the patient.

The series of radiograms which I am about to show and the fluoroscopic observations, which the construction of my table allows me to make, immediately before, during, and after each exposure, lead me to confirm to a large degree the observations made by Kaestle, Rieder and Rosenthal, whom I shall quote as follows:

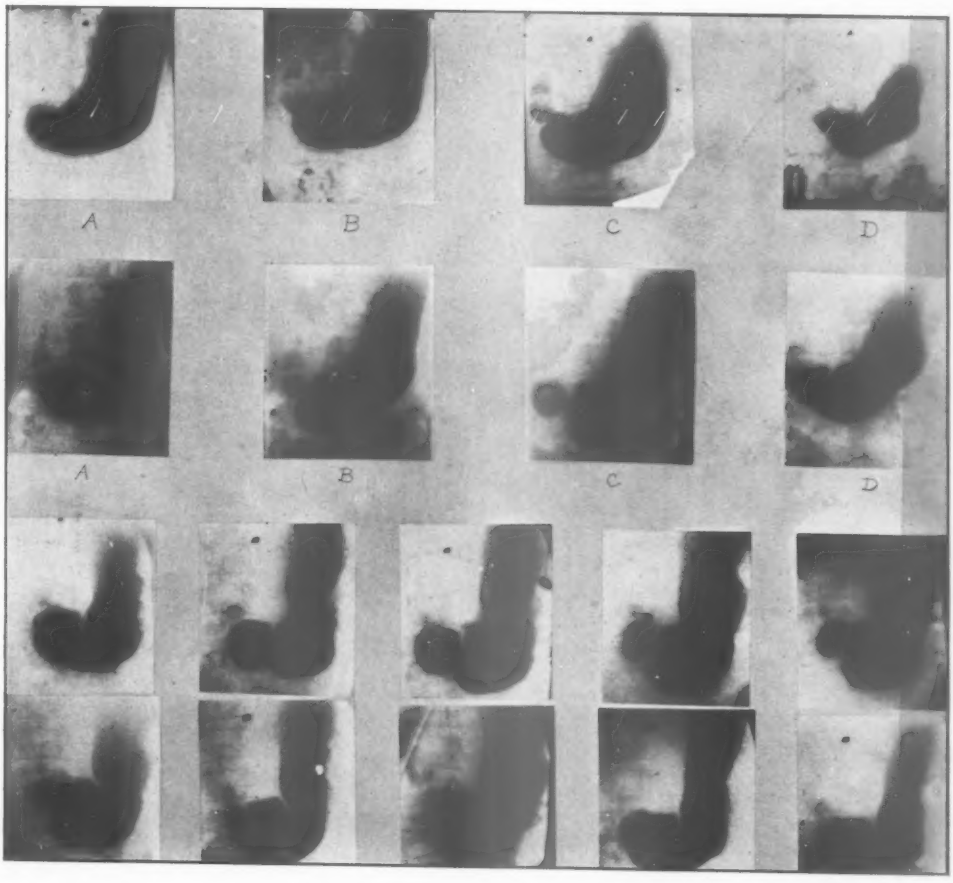
"Our investigation shows that during digestion there is no such division of the stomach into two distinct parts, and that a strongly differentiated antrum pylori in the old acceptance of the term does not exist. As our tracings show,

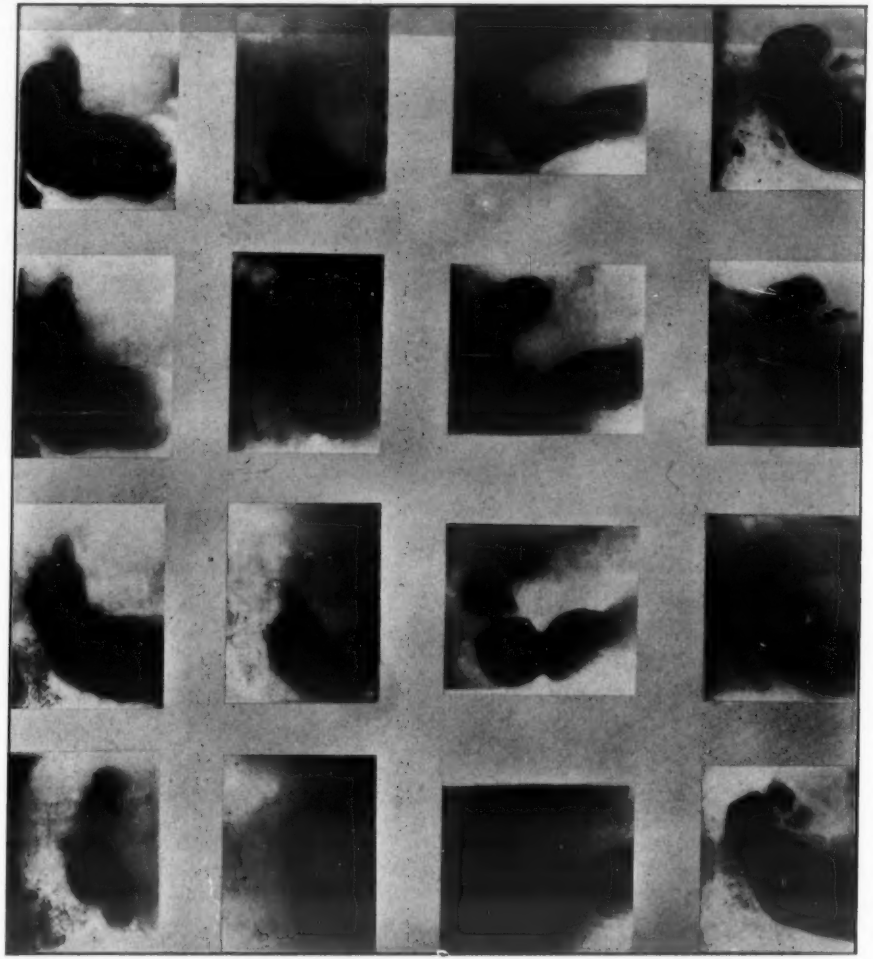
to have them centered according to the disks, which appear as markers. About two or three cinematographic exposures are then made of each film. This gives a duration to the peristaltic contraction which corresponds approximately to the actual duration of the contraction, but unfortunately, in the films I have to demonstrate, the radiograms were not sufficiently numerous to give a perfectly smooth appearance to the contractions.

In order to understand the peristaltic contraction of the stomach as observed in a series of instantaneous radiograms, it might be well to have some conception of a fairly normal contraction before investigating the abnormal. Mindful of the chaos, however, which has existed in the minds of physicians in general, and radiologists in particular, since Rieder gave his first bismuth meal and proved that the majority of stomachs do not lie in the abdomen in the old text-book fashion, I hesitate at the mere mention of normal peristaltic contraction. The description of the normal peristaltic wave was avoided by Kaestle, Rieder and Rosenthal, who refer in their article to the peristaltic contraction of abnormal stomach. This is a perfectly fair statement, because the girl whom they radiographed undoubtedly had a normal stomach. But in view of the variation in size, shape and position of the stomachs that functionate in a normal manner, so far as can be determined by all other methods of examination combined, the peristaltic contractions of these stomachs may be assumed to vary in even wider limits with the quantity and quality of the food and the mental condition of the patient.

The series of radiograms which I am about to show and the fluoroscopic observations, which the construction of my table allows me to make, immediately before, during, and after each exposure, lead me to confirm to a large degree the observations made by Kaestle, Rieder and Rosenthal, whom I shall quote as follows:

"Our investigation shows that during digestion there is no such division of the stomach into two distinct parts, and that a strongly differentiated antrum pylori in the old acceptance of the term does not exist. As our tracings show,


A
B
C
D
A
B
C
D



the formation of the new antrum does not commence at the spot where the final emptying of the stomach occurs, and is, therefore, not a mere relaxation of the contracted walls. If we adhere to the idea of an antrum pylori, then it is necessary to speak of two such antra existing side by side and at the same moment. We must speak of an old and a new antrum, as we have done for clearness of expression in the foregoing pages. As the old antrum disappears a new antrum is developed from the wall of the body of the stomach. This new antrum passes pylorusward, and ultimately exactly takes the place of the old antrum, whilst another new antrum begins to form. Moreover, if we wish to adhere to the term, our idea of the antrum pylori must be modified. In our opinion there is no true antrum pylori, any more than there is a sphincter pylori, in the sense of the older observers; 'What we see in the regio pylorica is an increase in the energy of the gastric peristalsis and an increase in the height and depth of the wave summits and depressions.'"

On the other hand, my observations have confirmed to a large degree Gradel's criticism of Kaestle, Rieder and Rosenthal's article. Gradel states that a large number of observations have shown him, that, at any rate, these observations are by no means constant I do not know whether these observations made by Gradel are based on fluoroscopy or a series of radiograms. Personally, I have been unable to detect these small contractions along the wall of the body of the stomach in a fluoroscopic examination, although a radiogram, made at the same instant when I observed the stomach fluoroscopically, shows them to be present. But in some of the cases, even the radiograms have failed to show the presence of these contractions.

Figure I shows four radiographs of a stomach in different stages of digestion. In this case, when the stomach was first filled with buttermilk and bismuth, there was little or no attempt at peristaltic contraction (A). In the next radiogram of this case (B), made about three or four minutes later, there was a very slight peristaltic contraction. This contraction was so slight as to be hardly discernible on fluoro-

scopic examination. Radiogram (C) shows a peristaltic contraction which was caused by external stimulus, namely: an attendant slapping the patient just before the exposure was made.

Instantaneous radiograms were made at intervals, and the fourth radiogram of the set (D) was made about one-and-a-half hours after the administration of the buttermilk and bismuth. When the stomach had partly emptied itself, these peristaltic contractions became more active, or at least were more clearly demonstrated on the plate. This series of radiograms shows that when a stomach is over-distended, the peristalsis is not so active as when it is partially filled. Whether, aside from the diminished quantity in the stomach, the production of hydrochloric acid is a factor in the increased peristaltic action of this particular stomach or not, I am not ready to state, but I believe this to be the case on the basis of other observations.

Figure II. This series of radiograms demonstrates the motor phenomena of digestion as described by Holzknecht in the Munchener medizinische Wochenschrift, and quoted by Kaestle, Rieder and Rosenthal in Archives of the Roentgen Ray of June, 1910.

"The motor phenomena of digestion, as seen by Roentgenoscopy, are as follows: While there is no active movement to be seen in the cardiac portion of the stomach, the lower portion of the greater curvature exhibits deep contractions. These depressions travel towards the pylorus, gradually getting deeper during their passage, till they get their maximum depth at the sphincter pylori, a point three or four fingers' breadth above the pylorus. The maximal point of depression is characterized by the length of time it remains in a state of tonic contraction, and by the fact that the contractions here are the most energetic of any part of the stomach wall.

"Opposite to this deep constriction of the greater curvature appears a similar depression of the lesser curvature, of almost equal depth. There is no movement of the lesser curvature visible in the upper part of its contour. Eventually the

depression of the smaller and that of the greater curvature meet, so that on the screen there is seen a clear line between the shadow of the contents of the corpus and of the antrum. Soon afterwards the shadow of the antrum disappears, its contents being emptied into the duodenum by a process of concentric contraction.

"The constriction three or four fingers' breadths above the pylorus, mentioned above, has the effect of a sphincter antri which periodically cuts off the antrum pylori from the body of the stomach. The circular constriction at this point is comparable in breadth and extent with the pylorus itself. The button-like reduction of the antrum is brought about by a process of concentric contraction. It is doubtful, however, whether there is a simultaneous peristaltic movement of the circular contraction toward the pylorus, or whether the circular depression remains stationary and the evacuation is brought about by a contraction of the longitudinal fibres alone."

Figure III. Seventeen radiograms have been made of this case and all show the peristaltic contraction in various stages, ten of which are selected for reproduction. This set of radiograms corresponds with the type of contraction which Kaestle, Rieder and Rosenthal consider normal. There are two distinct peristaltic contractions which may be seen in all the plates in different stages. The formation of the new antrum as the old one disappears is clearly demonstrated in this set of radiograms. These have been made so recently that there has not been time to center them properly and to prepare cinematographic films; if this had been done, the cinematographic reproduction would have shown a very much smoother and perhaps more normal peristaltic action of the stomach than the one which I am about to show. This set of radiograms, however, studied in detail and individually, affords the diagnostic aid which is required and proves that a projecting apparatus is not necessary for diagnostic purposes. Every one of the seventeen plates prepared in this case shows the detail which was present in the ten radiograms reproduced.

Holzknecht refers to one peristaltic contraction, Kaestle, Rieder and Rosenthal to two peristaltic contractions, but there are many cases in which three or even four distinct peristaltic contractions can be demonstrated by this manner of examination.

Figure IV demonstrates a one-and-a-half wave type of peristalsis which is intermediate between the one-wave type described by Holzknecht and the two-wave type described by Kaestle, Rieder and Rosenthal. Studying this case fluoroscopically, one would observe only the one well-marked peristaltic contraction and consider it as the type described by Holzknecht, but when studied radiographically there is clearly discernible a small secondary wave on the lesser curvature and Kaestle, Rieder and Rosenthal would claim it as a slight modification of their type of motor phenomena.

Figure V shows one of these cases where four distinct peristaltic contractions are demonstrable. The radiograms, unfortunately, do not include the entire fundus, but the peristaltic contractions are seen on the greater and lesser curvatures, well up toward the fundus of the stomach. These contractions become deeper as they move pylorusward and in radiogram (C) Figure IV, we have the button-like contracted antrum, the formation of a pre-antrum, and two or possibly three antra yet to come. I think these plates particularly emphasize the point referred to by Kaestle, Rieder and Rosenthal, namely, that it is unwise to preserve the term, "antrum pylori," and advisable instead to interpret what is seen in the region antrum pylori as an increase in the energy of the gastric peristalsis and as an accentuation in height and depth of the wave summits and depressions, only that the well-marked contractions in this case are not limited to the pyloric region. I do not claim that this last case was normal, being aware that it was a case of hyperchlorhydria. The peristaltic contraction is certainly more active than usual, bearing out the observations of Brauning regarding the relation between the tone of the stomach and its production of hydrochloric acid.

It seems to me that the simplest way is to consider the stomach as a sac in which there may be all degrees of peristaltic contractions, passing pylorusward. In extreme cases of atony of the stomach, the contractions are so few and so slight as to be indiscernible, either fluoroscopically or radiographically. Where there is more tone to the stomach, a single peristaltic contraction occurs, passing pylorusward, and when there is still more tone to the stomach, two contractions are demonstrated by instantaneous radiography where only one was discernible fluoroscopically. Progressively, a still better tone to the stomach is associated with three or even four contractions and waves, or antra. I believe that the most common is the stomach with two contractions and two waves or antra, but am not prepared to state that a single wave on the one hand, or three or even four waves on the other are beyond the normal limitations.* This point, I think, can only be decided by making a great number of radiograms of cases free from gastric symptoms, and after all other tests have shown the function of the stomach to be perfect. While these cases are interesting from a physiological and scientific standpoint, the particular application of this method of examination depends on a study of the interruptions of the contractions or waves as they progress pyloricward. Considering only the body of the stomach, Figure V illustrates a stomach of the two-wave type of motor phenomena with deep contractions like those described in Figure III, but when they are about two and one half inches from the pylorus they suddenly cease both on the greater and lesser curvatures. The failure of the pyloric end of the stomach to expand and contract in proportion with the body and cardiac end indicates some pathological process which prevents the normal dilatation of this portion of the stomach. There is, however, a slight variation in the lumen of the pyloric end of the stomach and the deepened rugae indicate that this is caused by adhesions encircling this portion of the stomach. This case was verified by operation and

*Note—More recent observations have shown that the stomach with three or four waves is the most common.

the entire pyloric end of the stomach was encircled by extensive adhesions.

Figure VI represents a similar condition where there are well-defined peristaltic waves along the lesser curvature until they reach a point about three and one half inches from the pylorus; here they cease suddenly and there is a perfectly flat surface which corresponds in shape and position with the lower surface of the liver. On the greater curvature the contractions become much deeper as if trying to compensate for their absence on the lesser curvature.

This case has not, to my knowledge, been verified by operative procedure, but the history of an operation on the gall bladder through this route tends to confirm the radiographic diagnosis.

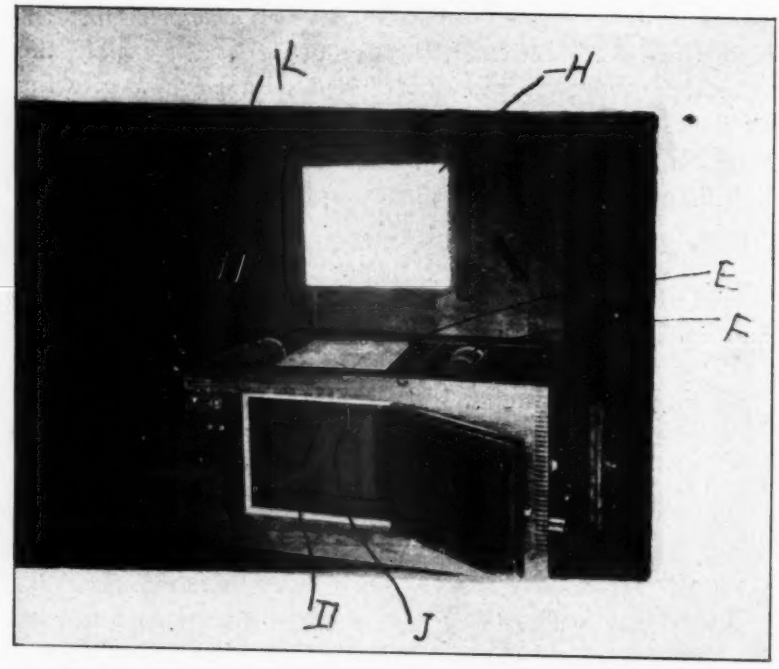
The radiograms which are about to be cinematographically demonstrated are not made sufficiently frequent to give a perfectly smooth appearance to the wave, and the fact that they are not well centered on this film gives a very vivacious appearance to the stomach, but it will serve to illustrate a motor phenomena of the stomach and the great scope of this method of examination.

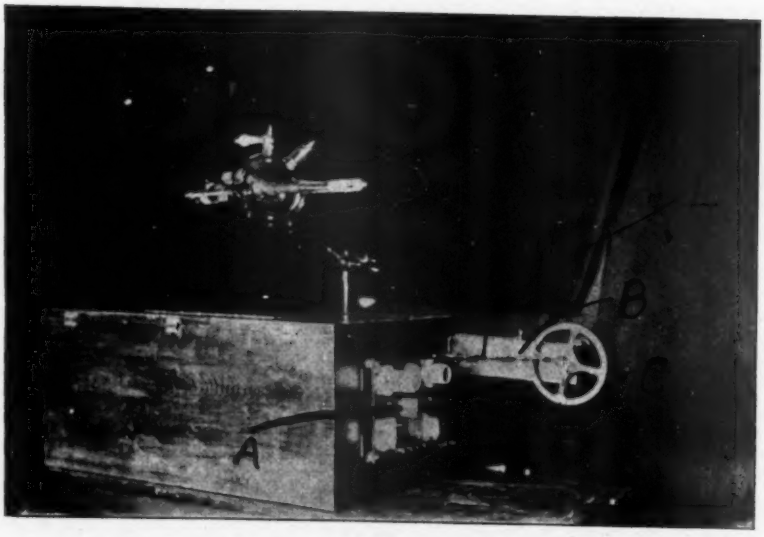
Resumé.—In closing I wish to give credit to Kaestle, Rieder and Rosenthal for the excellent work which they have done along this line, but would call attention to the fact that even their wonderful set of plates does not correspond to their rigid but correct definition of Roentgencinematography. I would also call attention to the difference between wave, contraction and cycle and the progression of the contraction from its origin to its termination. The duration of a peristaltic cycle is about two or three seconds, and at least ten or twelve radiograms should be obtained of different phases of peristaltic cycles.

There are various types of peristaltic contractions which are best described as the one, two, three, and four-wave types of contraction with an intermediate type between the one and two-wave type which might readily be claimed either by Holzknecht or Kaestle, Rieder and Rosenthal, as representing the normal gastric phenomena. These types of peristalsis I

will refer to as the unobstructed types of peristalsis in contradistinction to obstructed types of peristalsis where the contractions or waves are interfered with by new growths or adhesions near the pylorus.

The author makes no claim that these are true Roentgencinematographs as defined by Kaestle, Rieder and Rosenthal, but he does claim that from a practical diagnostic standpoint, a series of eighteen or twenty instantaneous radiograms made of different phases of different cycles, studied individually and collectively, is of great value in the diagnosis of new growths and adhesions at the pyloric end of the stomach and these may be made by any radiographer without the use of an expensive yet imperfect plate, or film-changing device. Therefore, this work is within the reach of any radiologist, and the author will lay no claim to Roentgencinematographic reproductions until he succeeds in making four radiograms per second of gastric peristalsis.


K
H
E
F
D
J


B
A

DESCRIPTION OF APPARATUS FOR MOVING PICTURES OF THE STOMACH.

BY LEWIS GREGORY COLE, M D, NEW YORK

This apparatus is made up in a box 30″ long, 18″ wide and 12″ high. It is lined with sheet lead ⅛″ thick. The cover is made of clear soft white pine and is covered with lead except an open space 8x10 which is in the center of the cover. Directly under this in the center of the box is mounted a closed magnetic circuit type of electro-magnet "D," having an aluminum plate 1/16″ in thickness 8x10 and mounted on the plunger of the electro-magnet and on top of this aluminum plate is placed the intensifying screen "E." The electro-magnet is adjusted by "J" so that the plunger moves 1/16″ and when this movement takes place, the intensifying screen is brought up so that it presses firmly against the sensitive film above it. At each end are mounted two pasteboard tubes "F." On one of these is rolled the sensitive film. This is drawn across the intensifying screen and attached to the roll at the other end. The bearings of each of these rolls are mounted on an arrangement for adjusting the tension so that they turn rather hard. This is so that there will be no slack to the film when it is in operation.

On the end that has the roll that winds up the film "K" there is an arrangement with a ratchet (this is inside of the box and cannot be shown on photograph) so that as the handle of the device makes a half turn the pasteboard tube "K" makes a full turn which just winds up 8 inches of film.

On the other end of the apparatus there is an electro-magnet "A" having a silver contact mounted on the plunger and another silver contact mounted on an adjustable screw. This electro-magnet is placed in series with the electro-magnet "D" that throws the intensifying screen up against the sensitive film so that they both work at the same instant.

On the connecting rod "L" between the ratchet arrangement that winds up the film is placed a spring contact "B" which closes the current through both electro-magnets. The current from the primary of the X-Ray apparatus is closed when the two silver contacts operated by "A" come together.

Both electro-magnets are operated by the same set of storage batteries or dry cells.

The apparatus operates in the following manner:

The first half-turn of the crank winds the film. When the crank is turned three-quarters round, the spring contact "B" is closed which operates the electro-magnets "A" and "D," closing the current through the primary of the X-Ray apparatus, at the same instant pressing the intensifying screen firmly against the sensitive film above it. Then just before completing the revolution of the handle the battery circuit through the above electro-magnets is broken so that the current from the X-Ray apparatus is turned off and the intensifying screen drops back away from the sensitive film.

The above cycle of events takes place with every complete revolution of the handle which can be operated by hand or an electric motor. The apparatus, of course, has to be loaded in a dark room or the rolls well covered with black paper, similar to the regular film roll, used in an ordinary camera.

THE VARIABILITY OF THE FOCUS POINT OF THE X-RAY TUBE AND A SIMPLE MEANS OF SELECTING A PICTURE TUBE.

BY GEORGE E. PFAHLER, M. D.
Clinical Professor of Roentgenology in the Medico-Chirurgical College, Philadelphia, Pa.

Every experienced Roentgenologist recognizes that the most important part of his apparatus is a good tube. We all recognize too that comparatively few of the tubes sent to us are really good "picture tubes." In the past we have had to exclude the bad tubes by producing a series of poor negatives, and after eliminating all other possible errors conclude that the fault is in the tube. Such knowledge is usually obtained at the expense of much material, and at times with the embarrassment of having made a faulty diagnosis.

Walter, Willey, Caldwell and others called attention to the various factors that enter into the production of a good tube, and to some of the causes of faulty tubes. In this brief paper it is not my purpose to enter into a discussion of the production of a good tube, nor to explain the factors which produce a faulty tube. I simply wish to record what I believe to be an original observation of the ***movement of the focus point in an X-ray tube, during an exposure of a half second, without variation in the current strength or in the vacuum,*** and that this occurs in some tubes more than in others, but that none are perfect.

In some tubes the variability of this focus point is so great as to make them worthless as "picture tubes." In such instance a fracture of a bone may be overlooked and a foreign body not be demonstrated. Tube No. 68, Fig. 10, was one of these extreme types, and yet when observed in my office by two leading Roentgenologists, who were judging the tube by its fluorescence and penetration, they said, "That is a fine tube." In the illustration, Fig. 10, which was a picture made

with this tube, you will see that all shadow lines are practically obliterated. In order to test its actual picture value, I placed two cross-pins upon the thigh of one of my assistants and made a plate. The shadow of the pin which lay in the direction of the longitudinal axis of the tube is obliterated, while the one lying transversely to the longitudinal axis is but faintly shown. This picture as a whole is poor in photographic effect and lacking in detail.

In this tube, the focal point moved in all directions, but more in the transverse than the longitudinal. For this reason the longitudinal pin is obliterated while the transverse is faintly shown.

In most of the tubes, in which the focal point is distinctly variable, it moves more in the transverse than the longitudinal, while in a few there is practically no movement in the transverse, but distinct movement in the longitudinal direction.

I find this variation in all makes of tubes; I do not know the cause. To all appearances, and judged by the fluorescence and by the size of the "burned point" on the target, the tubes may be identical, yet when put to the test there is great variation.

The tubes which show very little variation in the focal point make fine "picture tubes," and I find that they remain good "picture tubes" from the beginning until some accident happens to them.

I have made observation on over two hundred tubes, but have photographic records of the last sixty. I find a good "picture tube" in one out of four or five. I reserve the "picture tube" for diagnostic work, and find the others satisfactory for treatment. There is, of course, no objection to the variability of the focus for treatment.

TECHNIQUE OF THE TEST.

Fluoroscopic Method—Take a compression cylinder; stretch across the upper aperture two lead wires or bands, such as fuse wire, one wire corresponding to the longitudinal

axis of the tube and the second crossing at right angles; place the fluorescent screen beneath the cylinder; then in a dark room excite the tube until it takes the amount of current that the operator customarily uses in making exposures. The shadow of the wires will be thrown upon the screen, with some tubes sharply, with others very dimly. One can often see the shadow of the wires move a half inch (with the screen 18 inches and the cross wires 4 inches from the target of the tube) without varying the current, and without any apparent variation in the vacuum. Such a tube will, of course, not make any satisfactory picture.

A good tube, on the other hand, will give sharp cross lines and one can see no movement. Such a tube will make excellent pictures.

The Photographic Method—Just as a photograph will record more than the eye can see in other matters, so it will record finer variations than can be shown fluoroscopically. The same cross lines can be used, but I believe heavy wire large (⅛ to ¼) mesh is better. I usually test four tubes at one time, using ¼ of an 8x10 inch plate for each tube. This allows me to make good comparison and select the best tube. I make each exposure exactly the same length, timing it automatically. I use a comparatively slow plate, and time it exactly one-half second.

I always set my rheostat exactly the same and always use exactly the same amount of primary current—the amount that I usually use in making pictures. I then record the amount of milliamperage that will flow through each particular tube with this definite quantity of primary current and also the vacuum of the tube as measured by the Benoist Scale.

In this way I learn which tube has the most stable focus point, which has the highest penetration with the least resistance, and which gives the most photographic effect.

Fortunately the three effects generally, but no always, go together. It might be inferred that the stability of the focus point depended upon the vacuum, but this is not true. It

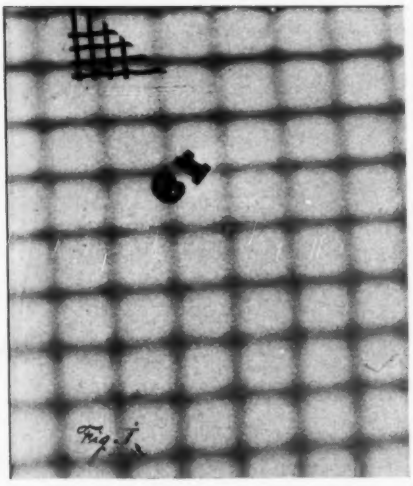


Fig. 1. Good picture tube (a six-inch bulb) shows practically no movement of the focal point. 45 m. a., one-half second 18 inches, Benoist 6. See small fragment of netting on the plate.

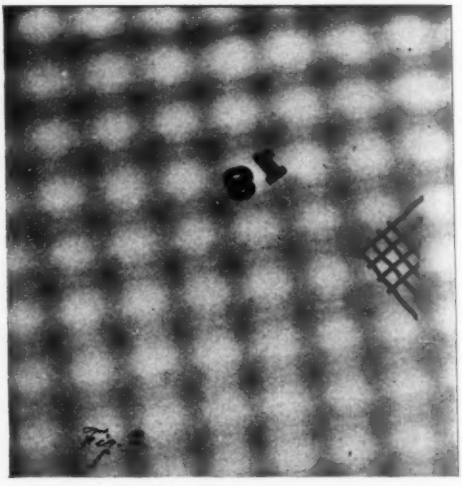


Fig. 2. Poor tube (six-inch bulb). See the double transverse lines and fairly sharp vertical lines, showing that the focus moved only in the direction of the long axis of the tube. Benoist 6; 35 m. a.

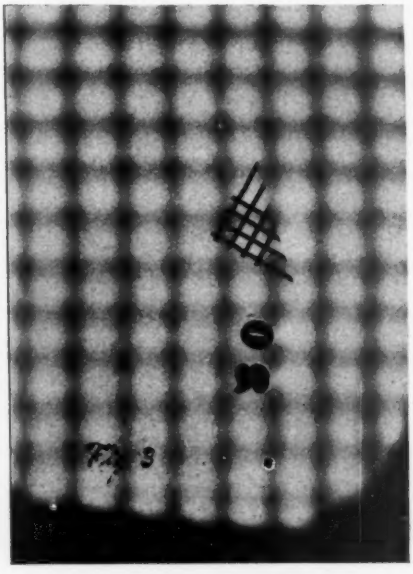


Fig. 3. A good tube showing slight movement of the focal point in the longitudinal direction. Benoist 6; 45 m. a.

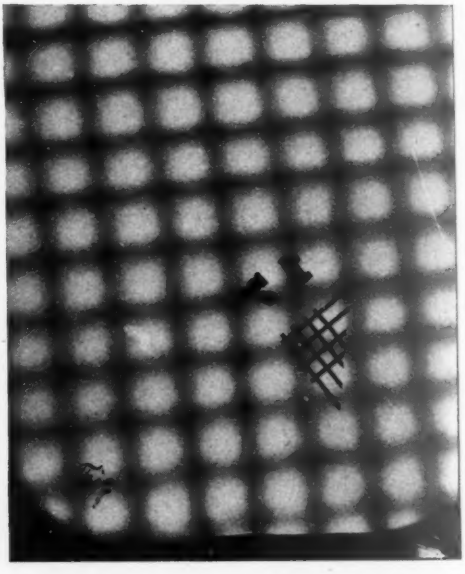


Fig. 4. A good tube (six-inch tube). Benoist 5; 60 m. a.

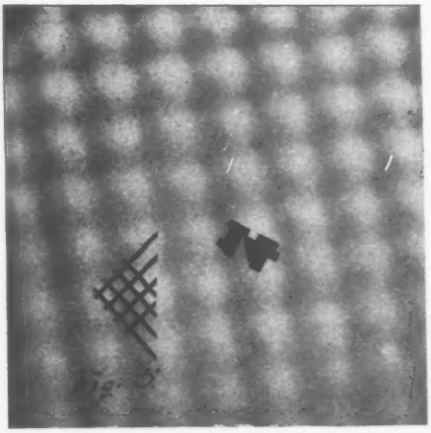


Fig. 5. A very poor tube (six-inch tube) showing movement of the focal point in both directions, but more in the transverse. Benoist 6; 40 m. a.

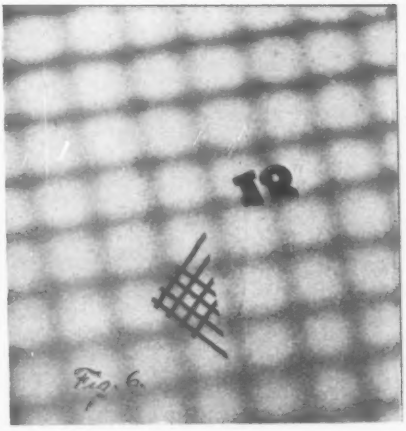


Fig. 6. Good tube (six-inch bulb). Benoist 6; 45 m. a.

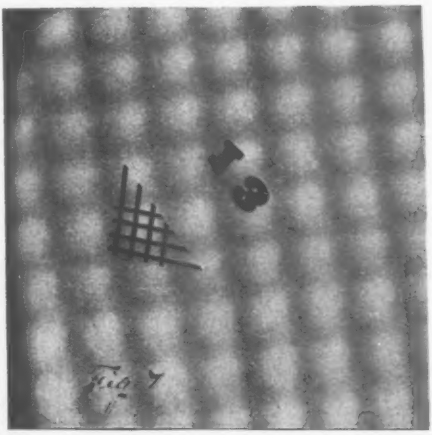


Fig. 7. A very poor tube (eight-inch bulb) showing movement of the focal point in all directions. Benoist 6; 45 m. a.

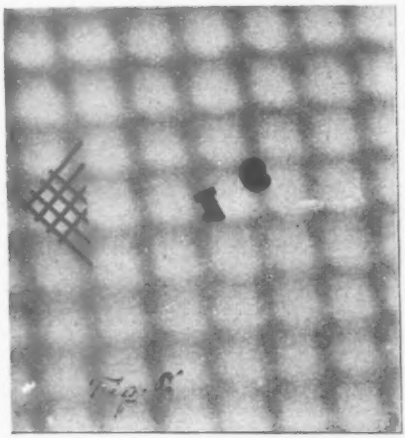


Fig. 8. A poor tube (six-inch bulb). See the double transverse lines indicating movement of the focal point in the longitudinal direction. Benoist 7; 35 m. a.

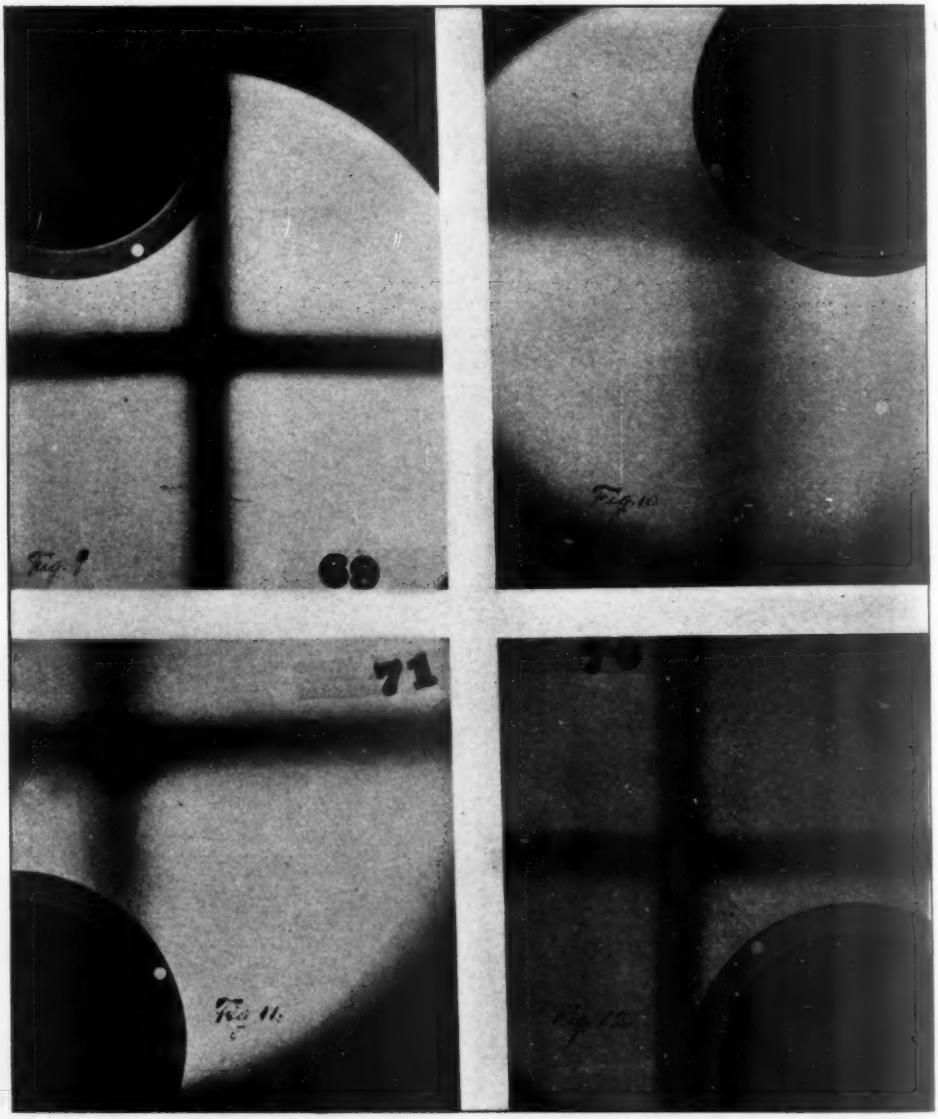


Fig. 9. Very good tube (six-inch bulb) showing a slight movement. Benoist 6; 40 m. a.

Fig. 10. A very poor tube (seven-inch bulb). Notice that the shadows of the fuse wire are practically obliterated.

Fig. 11. A poor tube (seven-inch bulb). Benoist 5; 35 m. a.

Fig. 12. A very good tube. Benoist 5; 45 m. a.

In all tests the focal point was 18 inches from the plate, and in each instance the tube was first tested until it would take the full current smoothly.

might also be inferred that a low tube would have a more stable focus, but neither the low nor the high are likely to be stable. In fact, I believe that the stability of the focus has no connection with the vacuum, although most of the good tubes register about Benoist 6. On the other hand, many tubes may register Benoist 6 and still be miserable tubes.

I have been especially impressed with the striking variation in so short a period of time. I noted it even in my highest priced imported tube to a moderate degree, even with an exposure almost instantaneous, the exposure being made with an automatic magnetic switch which broke the current the instant the main switch was closed.

Since one gets this variation in even an instantaneous exposure, it is easy to understand that the selection of a proper tube is of as great or greater importance than great speed in Roentgenography, for it matters little whether the patient moves or whether the focus of the tube moves, either producing a lack of sharpness of outline.

This may seem like a little thing to write up, but I can say that no single point in technique has been so helpful to me.

CONCLUSIONS.

1. The focus point of a tube is distinctly movable in nearly all tubes, but it is practically negligible in a selected few.

2. This variation can occur in a momentary or almost instantaneous flash.

3. It is the cause unknowingly, at times, of poor detail in plates.

4. "Picture tubes," with a focus point that is practically stationary can be selected both fluoroscopically and photographically.

5. If these tests were made by manufacturers, they would probably learn to make more uniformly good tubes.

DISCUSSION.

MR. H. CLYDE SNOOK, PHILADELPHIA: The Society is certainly in debt to Dr. Pfahler for this very valuable and timely discussion. I am sure that none of us realized the great variability in the focus of the X-ray tube until we heard this paper. Some of us have known something about this matter, and undoubtedly other members of the society will be able to throw more light on the cause of this variability than I can. I have been somewhat familiar with this probability knowing that the focus usually travels in an ellipse. This information is common knowledge and a number of articles have appeared in the foreign journals relative to this elliptical path of the focus on the target of the tube.

I believe that it is exceedingly difficult to determine the exact cause of this elliptical path. It sometimes assumes the approximate shape of a circle. It is my opinion based on work I have seen and some which I have been privileged to do that one of the causes of this trouble in the focus in the tubes is the probable electrostatic field that exists on the surface of the X-ray tube. To be able to control this electrostatic field, which, of course, is caused by the generator furnishing the current, it is necessary to modify the shape of the electrodes and the shape of the glass walls of the tube.

Some little work has been done in this direction with this idea in mind, but I am sorry to say that so far as I know nothing definite has been obtained from these experiments, although it is very reasonable to believe that this electrostatic field profoundly exerts an influence on the shape of the path. A dirty cathode or a dirty electrode or target will certainly cause an elliptical path or a movement of the focus of the tube during the time the current passes through it. The variation in the current strength causes a variability in the conductivity of the gas resting on the surfaces of the electrodes at various points and that changes the conductivity. The conductivity produced on the surface of the cathode is greater with a high current than with a low current, because there is a larger amount of rays given off from one part of the electrode than

from another. In other words, a cathode with small particles on its surface will cause a shifting of this focus as the current rises and falls in its delivery to the tube by the machine. A dirty target will do the same thing.

The shape of the face of the target and the shape of the walls of the tube certainly has something to do with this, and the experiments in this direction have not yielded very good results.

The exact cause of the phenomenon is a combination of a number of things, and I am sorry that it is unknown to me. The only practical way I know of selecting a tube is by some method like Dr. Pfahler's.

DR. H. W. DACHTLER, TOLEDO, OHIO: For a number of years I have been using a scheme to test tubes that has proven very satisfactory to me, but I do not go far enough. I have been using a bank of fine needles set one inch apart in a block of cork. The last needle is six inches from the plate and the first one inch away. I use them in one direction, however, which is not going far enough because the focus may be off in one direction and not in another.

I would like to ask Dr. Pfahler whether he carried on experiments to show whether a tube after it has been running for some time will show the same variation found present when the tube was first excited. There is often a shifting of the focus point, but some tubes settle down after they take the load. They become much more steady. I would also like to bring up the point whether some of the tubes which shifted when they were new would settle down after they had been used on his apparatus for a while and become regular and better tubes.

Of course, he used extremes. He placed the screen four inches from the target and the plate eighteen inches from the target. A number of manufacturers have been making tubes with a larger focus to withstand the heavy currents now in use. If in practice we will keep our tube at a comparatively long distance from the plate, it will really not be a disadvantage in practical work.

The most important thing that comes up in connection with rapid exposures which we desire to make is the fact that when the load is first thrown on the tube is not constant. What the changes are in the tube I am unable to say. I have recently had a lot of tubes from a certain manufacturer and found that they would not carry the current. They were tubes made with an osmosis regulator. When the tubes were first excited, they were low and after a few seconds they would not carry the current through the tube. Put a low tube to rest and when you start it again low, it would apparently change rapidly. In rapid exposures when the load is first thrown on there would be a rapid change in the condition of the tube. Some of this can, perhaps, be overcome with new tubes by strengthening them and adapting them to our types of machines.

DR. SIDNEY LANGE, CINCINNATI: This is one of the most important single technical points ever brought before the society. We have all been selecting tubes and weeding out the bad ones, but this method is simple and effective.

My method is much slower and not to be recommended. I find that a tube which has been used fairly hard for a number of exposures, half a dozen or more, depending on the composition of the anode, will show the defect in some way. Even when the focus point has not moved, the tube will be marred in some way. If you have used the tube for some time and you cannot see any indication of the focus point, set the tube in a glass shield marked to indicate center, and if you have any such little defect in the surface of the anode to tell where the focus is, it shows that the focus is either too large or it is moving.

I used to think that it was an indication when tube did not mark in any way that the surface of the anode was especially hard, but I discovered that such tubes would be best for detail picture work because the focus was either too large or the focus point was moving.

In looking over tubes as I have done since, I have weeded out tubes on which I could not see some defect in the finish at the focus point. Dr. Pfahler's method certainly is better because it gives us an immediate test of a tube. You can try it out and, if necessary, return it without first using it, as I have to do in my method.

DR. F. H. BAETJER, BALTIMORE: I do not think that Dr. Pfahler has given us anything new as to the variability of the focus point of the tube. What he has succeeded in doing is to give us a simple and easy method to demonstrate this variability. This is the most valuable paper ever presented before the society. It is a thing which we all had to learn by bitter experience.

These tubes which in the first place do not mark sharply do so after they have been toned up. Dr. Dachtler brought out the point that the tube would be irregular at first and then settle down. Mr. Snook's point as to the dirty cathode, I do not know that I agree with him as to dirty anode affecting the variability of the focus point. That has been my own experience. Then, I thought that there is another factor that entered into that. In the tube there are larger particles. You know that you can deflect the cathode stream. As the stream goes across it is charged in a definite way, but I think that each one of these particles deflects this cathode stream. In a high tube the impact on the anode is harder and we get greater penetration. My experience has been that in some tubes in which at first we get this elliptical focus point these particles of air are not equally divided. At least, that has been my idea. In other words, in place of having each particle of air as an elemental ion, we have groups of them. Naturally we have a greater force acting in one direction than in another. I have noticed that some tubes were turned into fairly good picture tubes after they were used for some time. Is it possible that something of that kind could produce this?

MR. SNOOK: This is one of the most interesting subjects, and I will answer Dr. Baetjer's question directly. This condition does exist. The tube at the beginning of its operation possesses a state of affairs entirely different from the state of

affairs existing at a later time. Before the current starts to pass through the tube there is present a condition which is never again repeated. There is a residuum of gas in one spot or in one portion of the tube which is changed from that position so that at no subsequent time does that body of gas reside in the same particular spot in the same way.

The conductivity in the vacuum of the tube is a very queer thing. One particular point I wish to call to your attention is the fact that not only the cathode particles emanating from the cathode have an influence on the conductivity of the tube but also the positive particles coming back from the anode influences the path of the cathode particles themselves. A simple experiment may be made by introducing some material between the cathode and the anode. It casts its shadow on the focus produced at the anode as well as upon the cathode. The insertion of a piece of material between the two electrodes stops the discharge between the two in a path in which the particles of discharge should be issuing. The conductivity between the two electrodes does not exist prior to the making of the electrostatic field between them. During the time that there is practically nothing in this space, there is residing on the surface of both electrodes a layer of gas. There is a layer of gas all around the negative surfaces of the electrodes also, —a great deal of gas also resides on the inner surface of the walls of the tube.

The percentage of free gas in the tube at this time is perhaps less than one per cent.,—that is, on the electrodes and the walls of the tube. If you have an induction coil which gives you a big current passing through the tube or a wave of current with a long period of silences between, just at the time that the current begins to rise and the electrostatic field is produced, there is produced a conductive carrier on each electrode, and they travel opposite each other. The one coming from the cathode has a mass generally about 1/1000 of the mass of the particle that starts from the anode. The number of little carriers that pass across through this space is proportional to the flow of the current at each instant as it rises and falls.

The electrostatic field varies also in proportion to the current that passes through between the electrodes. And if these particles that travel between the two electrodes are influenced by the electrostatic field and can be deflected, and if the electrostatic field is influenced by the shape of the walls of the tube, it is reasonable to assume that this electrostatic field would cause particles to impinge on the face of the target at different points as compared with another varying with the intensity of the current. This varies with each cycle.

It is easy to understand, then, that never is the state of affairs reproduced in the tube; that it is different at the beginning of the excitation of the tube and later on.

DR. EUGENE W. CALDWELL, NEW YORK CITY: I want to thank Dr. Pfahler for his method. I have used another method consisting of making a pin-hole radiograph of the plate itself. This can be done by making two lead boxes with fine holes, 1/16 of an inch on one side, the plate on the inside, the tube on the outside, and in that way you get a pin-hole photograph of the focus point of the tube. It moves and shows the shape. Incidentally, the same process enables you to show other sources of X-ray from the walls of the tube.

I quite agree with Mr. Snook that electrostatic charges on the surface of the tube probably play an important part in this shifting of the focus. It can be done in two ways,—one by shifting the cathode stream, and the other by shifting the cathode itself. Therefore, a good way to test this is to shake the tube, and if the cathode rattles it is fair to assume that it will move under the influence of the charge and thus shift the cathode stream. I have seen this occur but I do not believe that it is always the process. That is also a good test.

The point at which the charge can have the most effect on the cathode is at the cathode neck where the distance between the edge of the cathode and the plate is small. I think that most of these tubes in which the focus point shifts will be found to have a lack of concentricity between the neck of the cathode and the glass walls of the tube.

DR. CHAS. L. LEONARD, PHILADELPHIA: It is possible that this whole subject is one which is bound up entirely with the use of very heavy currents as we are now employing as compared with the older currents. I used to use a wire screen to test tubes in the early days when we were using low currents.

I do not find such great variation among tubes and it seems, too, that Dr. Caldwell's point of variation of fixation of the cathode has much to do with this, and that the high currents that pass through the tubes produce a variation through the influence of the electrostatic field on the cathode and make it movable, as well as the effect that the static charge itself has. Has Dr. Pfahler found any difference in the size of the tubes in relation to this variation of focus; that is, have the larger tubes, eight and eight and a half inch tubes, any difference in this factor from the smaller tubes, and that is the distance of the static charge on top of the residual gas has it produced any effect in the variation of the focus point? Has a larger tube having a static charge and residuum in tube farther from the cathode or anode any marked effect on the focal point?

DR. LEWIS G. COLE, NEW YORK CITY: At the Niagara meeting of this Society I presented a paper somewhat along these lines, and since then I have been using the pinpoint opening very much the same as Dr. Pfahler has been using the lines for selecting picture tubes. Whether this focus changes either in position or in size is relatively immaterial so far as we are concerned. Personally, I have considered the focal point as varying in size increasing from a small point to a large one rather than moving from side to side, or, as Mr. Snook said, in an eccentric position. It is immaterial, however, whether it moves from side to side, goes around or goes from a small point to a large one, or vice versa. Dr. Pfahler should be given a vote of thanks for bringing out these points.

Many of us have recognized this variation and have gotten at it in different ways, but after all it is immaterial. Another advantage of the pinpoint is that aside from studying the size and shape of the focal point on the anode, you can determine

by that method the relative amount of direct and indirect rays which are given off from the tube; that is, the direct rays given off from the focal point and the indirect rays given off from the wall of the tube. By the pinpoint you get the image of the tube in addition to the pinpoint of everything else.

While Dr. Pfahler referred definitely to the movement of the focal point, I think that it is unimportant whether it moves or not. But I would like to have him tell us for technical reasons only why he thinks that it moves from side to side or elliptical rather than being definitely changed in size one way or the other.

DR. P. M. HICKEY, DETROIT, MICH.: I would like to ask Dr. Pfahler whether this condition of a movable point on the target has any relation to the size of the burning point. I would also like to know whether he has noticed any connection between the results of his experiments and the condition of the cathode as we sometimes see it. Looking at the cathode from the point of the target we sometimes find a tube where the burning part of the cathode is quite round, and then we see that the dipping down of the burning point is sometimes down and sometimes over to one side. Personally I have been accustomed to judge something of the tube by the condition of the burning part of the cathode after the tube has been used.

DR. A. JUDSON QUIMBY, NEW YORK CITY: I believe that this change is due to the warping of the metal under the heat produced, and also, as Dr. Caldwell said, by a loose terminal. We know that metal warps when heated, and this warping may become permanent while the manufacturer heats the terminals when exhausting the tube. In our exposure we heat the tube to a high degree of temperature, and the warping becomes permanent and then we have a fixed target. The spreading of targets as I have seen them occurs when we use more current than that tube can stand. If a tube is exhausted to carry approximately a milliamperage of a certain degree and you increase that too much you force the cathode stream

forward because it increases the repulsion of the particles from one another, and it spreads out. I have also seen this point shift when the tube is transferred from one machine to another.

DR. W. H. EAGAR, HALIFAX, N. S.: I have been working under a great deal of disadvantage with my tubes and apparatus, and I have found with even the very best tubes that if I turn my current on into the tube with the regulator set I do not get as good results as if I charge my tube before endeavoring to regulate it. I do not know why that is so. When I turn on the current in the tube it as a rule is high. Without the regulator we get blurring. I have always attributed this blurring to inverse current in the tube, but it may be due to variability in the focus probably the result of deflection of the cathode stream; therefore, I think that charging my terminals first gives me a better and truer picture.

MR. H. CLYDE SNOOK: I would like to have Dr. Pfahler tell us what difference he finds in this movement of the focus point of tube when he makes the test on the coil, the transformer and on static machine.

DR. PFAHLER, CLOSING THE DISCUSSION: I appreciate this discussion very much. Most of the questions can be answered by reading the paper. I have opinions, too, but I did not care to give them. There are a number of things which I can answer, however.

In the first place, I found that the size of the tube itself did not make any difference. You get more good ones in large bulbs and as many bad ones in the small ones. In all of these tests I got the tube in as good condition as I could get it, just as I would do if I were going to make a picture. I endeavored to duplicate the conditions I would have if I were to make a picture. The whole thing is directed toward that end.

With regard to the relative variation in the static machine and coil and transformer. I have not made careful tests as to that, except that I feel that the result would be the same no

matter what the source of the current. I have used the tubes which I discarded on the static machine for treatment work and in one or two instances I have made plates and there is no difference. In other words, the tube is bad no matter where or how you use it.

As to seasoning the tubes, we all know that certain tubes get better after usage, but all tubes will not do this. However, the object of my paper was to select a good picture tube at the start, and I found that the tubes I selected are good tubes and remain good tubes no matter how much current I use. They are good tubes in themselves.

I think the trouble is around the cathode, either in its shape or its relation to the neck of the tube. But that is only a guess. As to the markings on the cathode of the tube, I mean the size of the burnt area, I suppose that we have all noticed a difference in the shape of the burning point, but there again one must use a tube quite a while before you know the area of the burning point and that is beyond the scope of my paper.

As to this being new, I can only say that it is not, but I have tried to work it out in a new way. The variability of the focus point is not new, but that it varies in the infinitely short time of a flash, 1/12 of a second, and that it varies to this high degree is, I believe, new.

As to the moving or spreading of the focal point, I think that if you had paid attention to my pictures you would have seen that that is not the case because you would have seen sharp shadows of the movement which you could not get in any other way.

COMPENSATING DISPLACEMENTS OF THE THORACIC VISCERA IN PULMONARY TUBERCULOSIS.

BY CHARLES LESTER LEONARD, A. M., M. D.
PHILADELPHIA.

The laws of physics render it essential that the lungs shall follow the thoracic walls and the diaphragm in their movements. This is because the lungs are distensible flaccid organs, open to the inrush of air, placed within a closed and semi-rigid bony and muscular case, which is capable of increase and decrease in its volume by muscular movements. Any alteration in the capacity of the lungs must be compensated for, or the excursion of the walls surrounding them must be decreased.

Compensation for the loss of expansion in the lungs takes place through an increase in the capacity of their normal area, or through the interposition between the visceral and parietal pleura of an area filled with air, or fluid, or both. These changes must take place in proportion to the volume of the lungs involved in a pathological process. They are in a measure appreciable by the ordinary methods of physical diagnosis. The changes which can be noted by inspection and mensuration are, however, less marked in ratio with the extent of the disease, than those within the thorax, which produce displacements or alterations in the position of the viscera.

Tuberculous disease must be far advanced or an acute pneumo-hydro- or pyo-thorax of large volume must be present before the limitation of the thoracic movements can be noted by inspection. Marked alterations in the position of the intra-thoracic viscera occur in the earlier stages of tuberculous disease, without visibly changing the excursion of the thoracic walls. These displacements occurring early in the disease have been generally overlooked. Until recently it was held

that the heart and greater blood vessels were so finely attached by ligaments to the skeleton and diaphragm that they could not be displaced except under extreme conditions. These views were apparently upheld by the post-mortem findings.

Since they have been recognized by the Roentgenologist in the living subject, it has become evident that the post-mortem changes hid the true condition. The correctness of this conclusion was shown as the result of a discussion which I had in 1909 with an internist connected with one of the largest institutions for the special study of tuberculosis. He did not believe that displacements of the viscera could occur so frequently in the earlier stages of the disease. He said that in some hundreds of post-mortems conducted at the institute they had failed to find such displacements. Some months later he told me that in the subsequent one hundred post-mortems they had found twenty-five or thirty displacements in the less advanced cases.

These pathological variations in the position of the thoracic viscera can be clearly shown only by the rapid Roentgenograms that eliminate the heart's motion. Their exact position and interthoracic relations can only be fully appreciated by the rapid stereo-roentgenogram.

The twelve cases used in illustrating the subject of this paper are taken from a series of one hundred cases studied by the rapid Roentgenogram. These cases were for the most part referred for examination from the State Dispensary for Tuberculosis through the kindness of Dr. A. P. Francine, and a part of them formed the basis of a paper read by me before the British Medical Association in 1908 (B. M. September 12, 1908). Many, however, including some of the more interesting pathological cases, were from private practice.

In the entire series of one hundred cases twenty-six displacements of the heart and aorta were found with three cases of pneumo-thorax. In seventeen cases the heart was displaced to the right; in four to the left; and in five a rotation took place with an upward displacement of the heart and aorta, so that the heart assumed an antero-posterior position. In two cases

a superficial pneumo-thorax was found overlying the lower left lung and in one case an acute hydro-pneumo-thorax of tuberculous origin was shown.

It is practically impossible to reproduce the Roentgenogram in ordinary printing with sufficient clearness to make its interpretation valuable. The twelve cases cited as illustrations of the subject of this paper have therefore been reproduced in tracings made directly from the individual Roentgen negatives. Varying types of line drawing have been used to diagramatically represent the different stages of the pathological process. An increased number of lines in one direction represents the line of contractile force. The tracings are accurate in detail and can be more readily appreciated by the reader. The accompanying stereo-roentgenograms, if viewed through the ordinary parlor stereoscope, will show in a measure the wealth of detail which can only be fully appreciated by the study of the original negatives on the large stereoscope.

The sharp outline of the heart, seen in these plates, shows that the exposure must have been sufficiently rapid to eliminate its motion, that is, they must have been taken in a fraction of a heart's beat. The time between the stereoscopic pains, required to shift the plates and tube, was one-half second. The total time for both exposures was, therefore, less than one second.

A review of the cases, in the entire series, shows that those cases in which no displacement of the viscera was present were early lesions, in which no fibroid change had taken place, or that the lesions were not extensive and symmetrical, or that the heart was bound down by adhesions between the pericardium and the diaphragm.

The unequal elevation of the two halves of the diaphragm, Williams' sign, was present in less than one-half of all the cases, and was not present where displacements of the interthoracic viscera had occurred.

The irregularities of the diaphragm seen in the cases illustrating this paper are due to adhesions between the pulmonary and diaphragmatic pleura.

The pathological displacements of the thoracic-viscera in pulmonary tuberculosis are the result of compensation for the destruction of expansive normal lung tissue by the disease.

The displacing force is the result of one or two changes or the combination of both, or as in the case of acute pneumothorax from the rupture of the lung. The consolidated lung area may undergo fibroid change and contraction, the contracting tissues drawing the heart and aorta with them, while the emphysematous lung on the opposite side assists in their displacement. That these two causes can act separately or together is shown in the illustrating cases. In some the heart and aorta are displaced in a direction entirely different from that of the pressure exerted by the emphysematous lungs or even where a marked emphysema is absent. Again a displacement is present and an extensive emphysema alone accounts for it.

In the surgical treatment of ordinary abscesses, evacuation and drainage are followed by compression, by the external dressing, to bring about coaptation of its walls and healing. Since external pressure can not be exerted within the thorax, the same result is achieved in the natural healing of abscess cavities in the lungs by the displacement of the viscera to produce compression.

In addition to the displacements which cause compression of the diseased portion of the lung, there is present in many cases an ossification of the costal cartilages and an approximation of the ribs over the affected area. As I have suggested in a previous paper the ossification of the cartilages may be a process of ankylosis to limit the motion of the ribs and place the parts more nearly at rest.

The compensating displacements may be divided into four groups: Displacements of the lung by superficial pneumo-thoraces; displacements of the heart upward and into an antero-posterior position; displacements of the heart and aorta to the left; and displacements of the heart or heart and aorta to the right.

DISPLACEMENTS DUE TO PNEUMO-THORACES.

In both the cases of superficial pneumo-thorax, the physical examinations which preceded the Roentgen examination failed to detect them, but their presence was confirmed by subsequent physical examinations. In both cases the primary lesion was of the left upper lobe, with no involvement of the right lung. It is noteworthy that in none of the similar lesions of the entire series which involved the upper right lobe did a pneumo-thorax occur. The accompanying stereo-roentgenogram of Case 1 shows the lower lobe of the left lung hanging like a lace curtain within the thorax, conforming to the curve of the thoracic wall and separated from it by an area clearly devoid of all lung structure. The upper left lobe shows distinct lines of fibrosis in the infiltration, while peri-bronchial lymph nodes are seen in both lungs. A later stage of a similar lesion is shown in Case 2, but with an entire absence of peri-bronchial enlarged glands. In this case the entire left lung is involved. The cavity seen in the upper lobe shows that the older lesion was there. The lower lobe is compressed but not entirely consolidated and is covered with a distinctly thickened pleura, which can be seen in the Roentgenogram. In marked contrast to the succeeding case of acute hydro-pneumo-thorax, the heart and aorta are displaced to the left, probably entirely as the result of the compensating emphysema of the entire right lung.

The next case (3) was of particular interest, as it was an acute tuberculous hydro-pneumo-thorax. This Roentgenogram was taken with the patient in the erect position, because of the fluid, which is seen as a level line just below the seventh rib. The lung is compressed upon the mediastinum and the heart and aorta are displaced to the right. This condition was readily recognized by the physical examination, but the position of the heart and aorta were not definitely determined. In this case both the lung and the heart with the aorta are displaced to the right.

ANTERO-POSTERIOR AND UPWARD DISPLACEMENTS.

This displacement was found in five cases of the entire series as illustrated in this paper by Tracings 4 and 5. The tuberculous lesions in all these cases were symmetrical and involved both upper lobes. The heart was not only rotated but with the aorta was drawn upward, showing that a decided force was exerted by the contracting fibrous tissue in the upper lobes. It is possible that the decreased superficial area of the heart presented to percussion in these cases, may account for an old opinion that the heart is small in tuberculous subjects. This opinion was not confirmed by the comparison between the size of the heart and the body weight of the patients in the entire series.

In Case 4 the heart is drawn up and rotated, so that as it rests upon its apex it presents a peculiar aspect as a wide band occupying the mediastinum.

In Case 5 the rotation is not so complete and the hand of mediastinal shadow is broader. In the stereo-roentgenogram of this case it will be seen that the heart lies within a very much thickened pericardium upon the left side particularly which accounts for the peculiar straight line shown as its left border. The heart, however, can be distinctly seen within the pericardial shadow. The stereoscopic picture also shows very clearly a dilated bronchus forming a cavity in the right upper lobe with the surrounding infiltration and fibroid change in both upper lobes with commencing softening and cavity formation in the left upper lobe.

In the entire series of cases the displacement of the heart to the right was four times as frequent as the left, in direct opposition to the opinion expressed by some authors. Of the greatest importance to the clinician is the fact, first demonstrated by the Roentgenologist, that the aorta is also displaced in almost every instance. It is possible in most cases to demonstrate by percussion the border of the displaced aorta that lies outside the line of the sternum, but almost impossible to show the one that lies beneath it. This fact has undoubtedly led to the diagnosis of aneurysm in many cases of displaced aorta. In

only one case of the entire series was an aneurysm found. It was suspected from the symptoms presented but could not be demonstrated by physical examination. The Roentgenogram showed an aneurysm buried in a mass of tubercular consolidation that occupied both upper lobes and a part of the lobes below them. In contrast to this is Case 8 to be spoken of later, in which the symptoms suggesting aneurysm were found to be due to a displaced aorta.

DISPLACEMENTS OF THE HEART AND AORTA TO THE LEFT.

In addition to Case 2 of superficial pneumo-thorax where the heart and aorta are displaced to the left, this group of displacements is illustrated by Case 6. Here there is an extensive involvement of the left lung. There is a cavity with surrounding consolidation and softening in the upper lobe, while consolidation and marked fibrosis have taken place in the upper portion of the lower lobe. The heart is drawn well over to the left but the arch of the aorta is in its normal position.

DISPLACEMENTS OF THE HEART AND AORTA TO THE RIGHT.

The extent to which the heart and aorta can be displaced upward and to the right, by fibrosis and contraction of a diseased area limited to the right upper lobe, is clearly illustrated in the stereo-roentgenogram of Case 7. The heart and ascending aorta are drawn up so far that the arc of the arch is increased and the separation from the decending aorta is so great that one can see through the arch. The right lower lobe is evidently emphysematous and presents upon its lower surface a dome-like protrusion of the diaphragm, evidently due to a localized adhesion of the pleura. The left lung shows no compensatory emphysema, but lines of infiltration and foci of tuberculous disease can be seen scattered through it, especially on stereoscopic examination.

The displacement of the heart and aorta in Case 8 gave rise to symptoms which led the laryngologist to suspect the presence of an aneurysm in an evidently tuberculous subject. In addition to a paralysis of the left vocal cord the case presented other very interesting features, and has been reported

in detail by Dr. E. L. VanZant, by whom it was referred for Roentgen examination. The Roentgen plates showed that no aneurysm was present but that the heart and aorta had been displaced far to the right. The tuberculous lesion was confined chiefly to the right upper and middle lobes, where consolidation, fibrosis and cavity formation had taken place.

The multiple lesions of a rapid tuberculous process, as well as a moderate displacement of the heart and aorta to the right, are shown in Case 9. Here we have infiltration, consolidation, fibrosis, an old walled cavity, the breaking down of tissue to form a cavity, a cavity in the left upper lobe without a thickened wall, and an area of the lower right lobe covered by thickened pleura.

The remaining cases are illustrations of displacements to the right of the heart or heart and aorta, and are the types of cases readily recognized and termed dextra-cardia. Displacement of the aorta to the right is also present, but had not been determined by the physical examination, while Case 12 is the only case in the entire series in which displacement of the aorta did not occur with the displacement of the heart.

The moderate displacement of the heart and aorta to the right in Case 10 can be accounted for by the adhesion of the pericardium to the diaphragm and the general fibrosis which has accompanied the miliary tuberculosis.

The small masses of miliary tubercle are seen distinctly, especially in the original negative and the lantern slide, scattered throughout both lungs accompanied by bands of infiltration. The upper right lobe is consolidated, with fibroid change and cavity formation.

The wide displacement due to consolidation of the entire right lung with fibroid contraction and emphysema of the left lung is illustrated by Case 11. The original seat of the disease is shown by the advanced fibroid change in the right apex and the cavity formation. The heart and aorta are drawn far over to the right and slightly upward. The spread of the disease to the left lung is seen in infiltration and early cavity formation in the left upper lobe.

Another illustration of dextra-cardia with advanced fibroid change is shown in Case 12. The apex of the heart is displaced nearly to the median line. In this case, however, we find the arch of the aorta in its normal position. This absence of displacement is probably due to the general fibrosis which is evident throughout both lungs and the absence of consolidation and extensive fibrosis of the right upper lobe. This is the only case where the aorta was not displaced and also the only one of displacement to the right in which the right upper lobe was not extensively involved by the disease.

In all the cases illustrating this paper, and in the entire series from which they are taken, the clinical findings have been compared with the Roentgen diagnosis, and the points brought out alone by the Roentgen examination have been subsequently confirmed by a physical examination.

The Roentgen method of examination has been shown to add to the knowledge obtained by other methods of physical diagnosis, by detecting superficial areas of pneumo-thorax, by showing that the aorta is generally displaced with the heart and by making evident the effect of fibroid change in displacing the viscera through its contraction. In addition, it is a valuable mechanical method of observing and recording the changes, and displacements produced within the thorax by tuberculous lesions of the lungs. It also assists in the understanding of the processes of repair which take place in the closing and healing of old cavities, while it forms a permanent record for comparison with that obtained in later examinations, thus showing the progress of the disease or of the process of repair. It is self-evident that Roentgenoscopic examinations of the thorax and lungs, that is, the visual examination by means of the Roentgen rays and the fluoroscope, can not afford accurate permanent data such as are secured by the rapid Roentgenogram and particularly the stereoscopic Roentgenogram. There can be no doubt that viewing with the fluoroscope is a cheaper method and that it is less accurate since it gives data that are only visible to the eye of one observer. It possibly affords an advantage in viewing the movements of the diaphragm, but it can not eliminate the effect of motion

produced by the heart's beat and does not show the minute detail essential to a careful diagnosis. An examination sufficiently long to enable the observer to gain any valuable information must necessarily expose the patient to the rays for a far greater period than the second or two required for the rapid stereo-roentgenogram.

The series of cases illustrating this paper in tracings, stereo-roentgenograms and lantern slides shows the contribution which Roentgenology has made to the knowledge of the pathological displacements of the thoracic viscera produced by the lesions of pulmonary tuberculosis.

COLLABORATION ESSENTIAL IN THE DIAGNOSIS OF SURGICAL CONDITIONS OF THE KIDNEY AND URETER.

BY JOHN HUNTER SELBY

It may be stated safely that few Röntgenologists have escaped the grave situation in which an erroneous interpretation of an X-ray plate has been responsible for operative procedures and the surgeon demands a postoperative or perhaps postmortem explanation. In such an event it is comforting to be able to prove that the error was unavoidable, and not the result of inaccurate technic. All Röntgenologists of experience have, at times, interpreted plates incorrectly, and only with the utmost care and earnest endeavor do they avoid errors in most cases. However, with improved technic, and a closer cooperation with their fellow practitioners, the percentage of failures should be reduced to a minimum.

In no branch of X-ray work are there greater opportunities to work out refinements in differential diagnosis, of such vital importance to patient and surgeon than in the field of surgical diagnosis of the urinary tract. The urgent need for a more complete and systematic Röntgen examination of the kidney and ureter cases, than that which is afforded by the work of novices should be realized by all specialists as well as by general practitioners. Physicians are too often called upon to deal with inaccuracies in Röntgenographic work, and many of them show unusual patience in their toleration of unsatisfactory and, frequently, misleading examination.

In explanation of the present unsatisfactory and inaccurate condition of much of this work, one should consider (1) the comparative newness and rapid development of this branch of X-ray work; (2) insufficiency of clinical material, proper equipment, and detailed technical information, and opportunity for systematic instruction; (3) the failure of the physician

to anticipate the necessity for an adequate initial outfit, and the cost of its installation and maintenance; (4) the presence within the field of Röntgenology of so many amateurs and transients whose experience in the interpretation of plates is insufficient.

We have a right to regard with suspicion all diagnoses based on data known to have been obtained under such conditions.

The methods commonly employed by the inexperienced X-ray worker in the diagnosis of genito-urinary conditions are about as follows: A cathartic may or may not be given the day before. One or more exposures of the abdomen and the pelvis are made. The plates commonly used are slow, and the exposure prolonged. Shadows of various kinds are frequently met with, and, depending largely upon whether a given shadow is in the line of the ureter or in the region of the kidney, a "snapshot" diagnosis is made. The second examination is rarely deemed necessary to confirm the first, and a cystoscope is seldom employed to "check-up" the findings. Such procedures must necessarily result in inaccurate interpretations, since it is very difficult to identify many of the suspicious shadows which appear in most plates of the bony pelvis.

I will not here name the various objects capable of casting shadows, which must be ruled out. In some instances the passing of a stylet, particularly where a clear set of stereoscopic plates can be obtained immediately, will aid us materially in localizing a shadow. But, as has been emphasized by Braasch, the stylet alone does not always localize a given shadow. A small calculus in a ureteral diverticulum is one instance where it might fail. Again, a phlebolith may lie so near to the ureter, or a calcareous deposit in the wall of the ureter may occupy a position so close to the stylet as to make it impossible to be positive of its exact location or nature. We have encountered this condition many times, and in several instances, at operation, have witnessed the practical demonstration of our errors in interpretation. These failures should stimulate us to renewed effort to work up a more accurate technic.

Phleboliths occur either singly, in strings, in groups, sometimes unilaterally placed, or on both sides in the bony pelvis. Their distribution is irregular in many instances. They not infrequently occur in conjunction with ureteral calculi from which their shadows alone are indistinguishable. In appearance they vary so widely that recognition and identification are often attained with the greatest difficulty, particularly in those cases where the shadows occur upon the side where we strongly suspect trouble. Here again it is absolutely necessary to remove all possible doubt and make every effort to be positive in our findings. For example, we should not be content to say of a given "suspicious" shadow, "It is most likely a phlebolith, but it happens to be situated on the side where we expect a ureteral calculus." In over half of the cases that are referred to our laboratory for examination phleboliths give more trouble than any other three groups of objects that necessitate "proving up."

There is, however, a method of examination at our command by which we can clear up all doubt in at least 95 per cent of these cases. The first essential in this method and its success depends on absolute co-operation between the cystoscopist and the Röntgenologist. Each specialist has his separate and distinct work to perform. It is manifest, therefore, that at the outset a combined technic must be carefully worked out by the two examiners so that the various details may be employed in harmony.

This co-operative examination opens up additional possibilities, especially in that large group of abdominal cases seen in daily practice, which exhibit an indefinite line of symptoms referrable perhaps to the appendix, gall-bladder, stomach, duodenum or spine, but with a strong possibility of involvement of the genito-urinary tract. Such cases require careful study, and some of them tax every means at our command before we can approach an accurate diagnosis.

In St. Mary's Hospital (Mayo Clinic) all such cases are referred to the Röntgen laboratories for examination. The routine examination in this clinic is as follows: The clinician in charge takes a full history and makes a physical examina-

tion. A 24-hour specimen of urine is analyzed and perhaps a gastric analysis made. These may throw considerable light on the case and yet not fix the diagnosis. The case is then referred to the Röntgen Laboratory after the proper preparation of the intestinal tract. A set of stereoscopic plates of the upper abdomen, and a second set of the lower abdomen and pelvis are made by the rapid method, that is, while the breath is held. Rapid plates (10x12) are used routinely. The exposures range from a fraction of a second to, in rare cases, three seconds. Intensifying screens are seldom needed. Should this examination fail to reveal any abnormality of the genito-urinary tract the diagnosis is still in doubt. The patient, therefore, goes through a second preparation of the intestinal tract and is referred to the cystoscopist the following day. In the meantime, the original plates are studied and a consultation is held between the physician in charge, the Röntgenologist and the cystoscopist. This, at times, furnishes the cystoscopist with much needed information, and establishes a new working basis for the Röntgenologist, should subsequent events indicate a second X-ray examination. The cystoscopist now makes his thorough routine examination. This alone may clear up the diagnosis and thus eliminate the necessity for the "combined examination." It may confirm the original X-ray findings or disprove them. Again, it may give evidence of trouble not heretofore suspected. Therefore the indications for the combined examination depend upon the *original X-ray findings* plus the findings at the cystoscopic examination.

At this stage in the examination the procedure must vary with the individual case. Voelcker in 1906, demonstrated that a solution of silver colloid (collargol) injected through the ureteral catheter would produce a shadow outline of the renal pelvis on the X-ray plate. He demonstrated several cases of hydronephrosis and suggested further possibilities of the method in renal diagnosis. Early in 1909 Braasch applied the method in this clinic. Since then it has been used here in over 600 cases and its value amply proven in the diagnosis of numerous pathologic conditions of the urinary tract. Silver colloid solution possesses a relatively high power of absorption for

X-rays, as compared with the surrounding tissues. If used while fresh in a strength of not over 10 per cent., an effective diffusion with the urine present avoids precipitation of colloidal silver. The density of the shadow cast depends upon several factors: (1) the skill of the operator who makes the injection; (2) the amount injected; (3) the thickness of the overlying tissues and their consistency; (4) the quality of rays in use.

The injection should be done by the cystoscopist, who is familiar with the peculiarities of the case. The patient, being more or less nervous under such circumstances, is apt to look with suspicion on any additional manipulations. The patient must be kept perfectly still and the exposures should be as short as possible in order to secure clearness and density. All of these factors must be taken care of simultaneously. In the hands of a skilled examiner the procedure is usually attended with but little discomfort.

There are two efficient methods of injecting the kidney and ureter with silver colloid: (1) the *gravity* method and (2) the *syringe* method. The important factor in each is to avoid over-distending the renal pelvis, its calyces, and the ureter. Should over-distention occur, a renal colic may cause a violent contraction which prevents getting an outline of the pelvis in repose. The shadow of the pelvis in contraction is misleading and valueless. During the attack of colic the patient is restless and even if the exposure be short we are apt to get a blurred image which is also confusing.

Should, for example, the original plates show a shadow at the region of the uretero-pelvic juncture on the right side,—perhaps shown distinctly in both plates of the stereoscopic set—we should record its presence, appearance, and apparent location, and call it a "suspicious shadow" to be investigated. The case is referred to the cystoscopist for further examination. We do not dare to risk making a diagnosis on the original plates alone, even when the history and symptoms would seem to justify it. Experience in a large number of these cases has taught us that the most careful interpretation, in

many instances, is unsafe. Therefore, we are content to call these shadows "suspicious" until we have established their identity and their approximate location.

At the subsequent or *combined examination* we seek not only to locate and identify the calculus, if present, but we endeavor to gain additional information, such as demonstrating the possible presence of an associated ureteritis, constriction or local dilatation of the ureter, hydroureter, hydronephrosis, pyonephrosis, or deformities. Should the above procedure exclude the "suspicious shadows" as a possible source of trouble and fail to demonstrate any other deviation from the normal, the genito-urinary tract may be eliminated from the examination. But the combined examination may have demonstrated any one of a number of important surgical conditions; for example, an anatomic or pathologic stricture, kink, constriction, tortuosity, an anomaly of the ureter, nephroptosis, pyonephrosis, hydronephrosis, tuberculosis or chronically inflamed renal pelvis, variation in the shape and contour of the normal pelves and calyces, the presence of organized or amorphous deposits in the kidney, or a renal neoplasm.

Oftentimes one is called upon to rule out the kidney in the case of an abdominal tumor with which it may easily be confused. Here the combined method of examination is of the greatest value. We cannot only locate the position of the kidney and thereby ascertain the relative position of the tumor, but experience, gained by the study of a large number of plates outlining the renal pelves has shown that where the kidney itself is involved to any extent by a tumor one can usually find distinct evidences of it in a clear X-ray plate of a skillfully injected renal pelvis.

None of the above mentioned conditions occur so rarely as to be ignored as a possibility in a given case. All of the conditions mentioned above have been demonstrated in this clinic within the past two and one-half years, and some of them many times.

These observations are based upon a study of 1986 abdominal cases of the type referred to above, radiographed during the past eighteen months in St. Mary's Hospital (Mayo Clinic). Of these, 300 were examined by the combined method, colloidal silver being used.

References.

Braasch: Surgery, Gynecology & Obstetrics, April, 1911; Annals of Surgery, Apr. and Nov., 1910; Jour. A. M. A., Dec., 1911.
Voelcker: Beit. z. klin. Chir., 1906, lii.

DISCUSSION.

DR. EUGENE W. CALDWELL, NEW YORK CITY: I doubt whether anywhere in the world there can be gathered together such a large collection of interesting cases of this kind. The history of Roentgen diagnosis began long ago. It is divided into distinct periods. Dr. Leonard ten or twelve years ago did a great work for us by making some wonderful plates showing stones in the urinary tract. Dr. Selby has shown us how necessary is the co-operation between the roentgenologist and the urologist in this work. In the beginning of this work we were very much delighted when we were able to show a stone. Often we failed to show it when it was there. This was followed by a period of over-enthusiasm and it was claimed that every stone could be shown by the ray.

Then we became more conservative, and we said that we had found a shadow which might be caused by a stone, or when we failed to find it, we said that it might be there. Then came the argyrol injections to help us in this work.

Dr. Selby works under unusually favorable conditions. To do this collargol and argyrol work promotes the development of the highest degree of skill in this work and this can be done best only in a hospital. It is exceedingly difficult in private practice. One day you will have a surgeon who pays absolutely no attention to asepsis, and the next you will have the man who is over-zealous in his attempts to secure asepsis.

We must encourage this teamwork. Without a high degree of co-operation between the urologist, the surgeon and the roentgenologist you cannot get such results. At least, we cannot hope to get the best results in this line until we get teamwork.

I am glad that Dr. Selby spoke about the stereoscope, although I am not quite in accord with all he said. He says that he does not look at these plates stereoscopically. The kidney region, it is true, does not offer a favorable field for stereoscopic work, but the region of the pelvis is quite favorable for such work. Stereoscopic examination of these plates will, I think, often make unnecessary further work with the cystoscope. I have in mind two cases, one especially, where two stones were superimposed. There were shadows which we thought were due to thickened places in the bone. The stereoscope showed them distinctly to be stones. It always takes a little time to look at these plates stereoscopically, but every once in a while we gain some exceedingly valuable information in that way.

DR. PERCY BROWN, BOSTON: Every one must be prepared by this time to give the urologist two "don'ts,"—the pre-roentgenologic "don't" and the post-roentgenologic "don't." The pre-roentgenologic "don't" is, Don't mess around with your urology before the time that you finally make your cystoscopic examination for roentgenologic purposes. If you do that, you cannot get the patient to the roentgenologic laboratory. Just as little pre-roentgenologic activity on the part of the urologist as possible is eminently desirable.

The post-roentgenologic "don't" is, Do not squirt the patient too full of solution; do not ram the syringe in too hard; do not use too much collargol, because after the urologist has left, you will have to put the patient to bed and keep him there under morphine for several hours. He is having a fine renal colic which makes it impossible for him to leave your laboratory.

DR. CHAS. L. LEONARD, PHILADELPHIA: I want to congratulate Dr. Selby on this work, but I cannot refrain from saying that I wish he would look at his plates stereoscopically. He should do so at least once in a while and see how much can be learned from this method. I recently examined plates stereoscopically and located five stones in the lower ureter. The surgeon would not have found the fifth stone if I had not located it stereoscopically. I have a plate in which the stones can be seen stereoscopically very plainly when ordinary examination of the plate would not show them distinctly. A stereoscopic examination certainly gives more information than can be obtained from the plates.

DR. SELBY, CLOSING THE DISCUSSION: I want to correct a misunderstanding. I hope that I did not so far forget myself as to say that I never examine these plates stereoscopically. I do not depend on it, but I frequently examine them. One of my points is, that if stone is there, well and good, but the important thing is to show where it is. I frequently read my pelvic plates stereoscopically.

Dr. Caldwell spoke about teamwork. There is no other term in the English language that expresses it so well or so accurately as the word "teamwork." Teamwork is essential and we must have it not only in this work but in all our examinations.

Dr. Brown calls attention to the difficulties after the cystoscopist has had the patient. That is the reason why in Rochester we make a routine examination with the Roentgen ray before the patient is sent to the cystoscopist. The patient comes to the Roentgenologic department first, so that one entrance of the cystoscope does the whole work. With Dr. Stover's method the patient does not have to lie there too long and he can stand up without being too tired.

If you over-distend a kidney, there is a little pain, and all operators have found that there is a point which will tell you when to stop. There is a little premonitory distress. Usually about 10 c.c. is the amount injected.

Fig. 1. X-ray No. 9658. Region: bony pelvis. Original plate shows multiple shadows of various sizes. These must be identified. Diagnosis: (A) several stones in bladder, (B) multiple calcareous deposits in the prostate, and (C) vein stones. Confirmed at operation.

Fig. 2. X-ray No. 9062. Region: left lumbar. Original plate, showing large square shadow presumably in renal pelvis and small shadows in lower pole. In such a case it is necessary to ascertain presence or absence of hydronephrosis, pyonephrosis, or any other associated condition. At operation large square stone removed from pelvis, stony calculus from lower calyx and parenchyma.

Fig. 3. X-ray No. 8630. Region: right abdomen. Position face down. Original plate showed suspicious shadow region of right kidney, suggesting gall-stone. This second plate, face down, strengthened the suspicion of gall-stone. An injection of the renal pelvis with colloidal silver showed the shadow to be three inches above position of the low-lying renal pelvis. Diagnosis: gall-stone. Removed at operation.

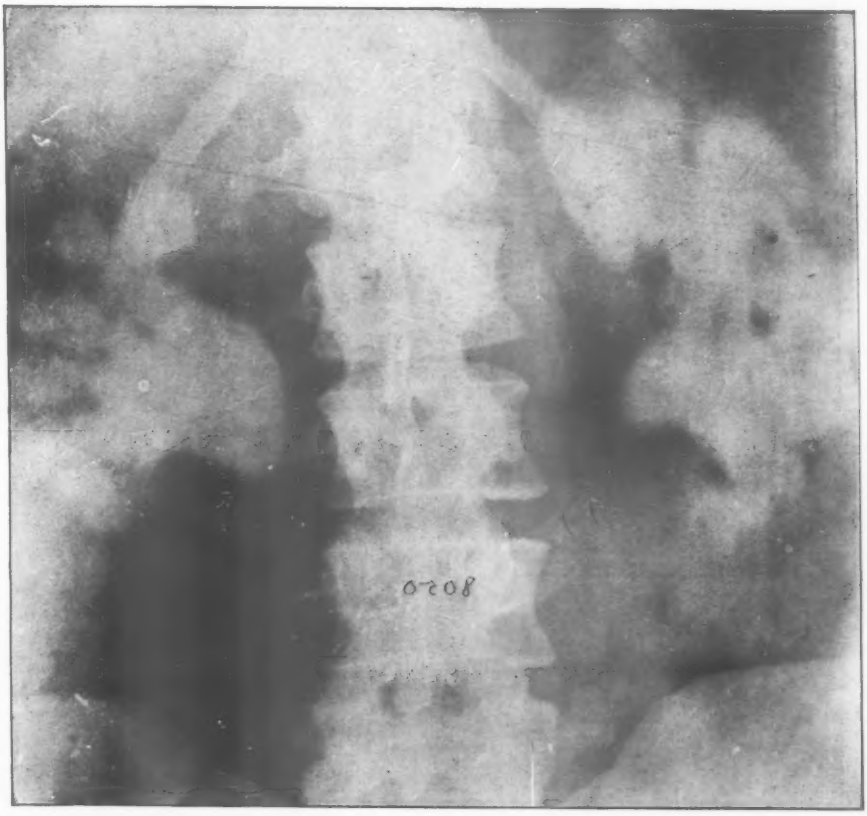


Fig. 4. X-ray No. 8050. Both lumbar regions. Original plate. Note enormous branched shadow on right side, and large fan-shaped shadow on left. In this case it was all important to determine whether one or both kidneys were functionating sufficiently to justify operation. Plate of the injected kidneys (not shown) revealed a pyonephrosis of left kidney, an absence of pyonephrosis and hydronephrosis in right kidney. Operative findings: a branched stone size of small orange in right kidney, multiple stones of various sizes and an associated pyonephrosis in left kidney.

Fig. 5. X-ray No. 12288, a. Region: left pelvic. Original plate shows suspicious shadow in region of ureteral-pelvic junction.

Fig. 6. X-ray No. 12288, b. Colloidal silver injection locates suspicious shadow in ureter at ureteral-pelvic junction and demonstrates a dilatation of the ureter above the calculus.

Fig. 9. X-ray No. 10771. Region: right lumbar. Demonstrates a suspicious shadow over sacro-iliac joint. Note outline of ureter curving over shadow to low-lying kidney.

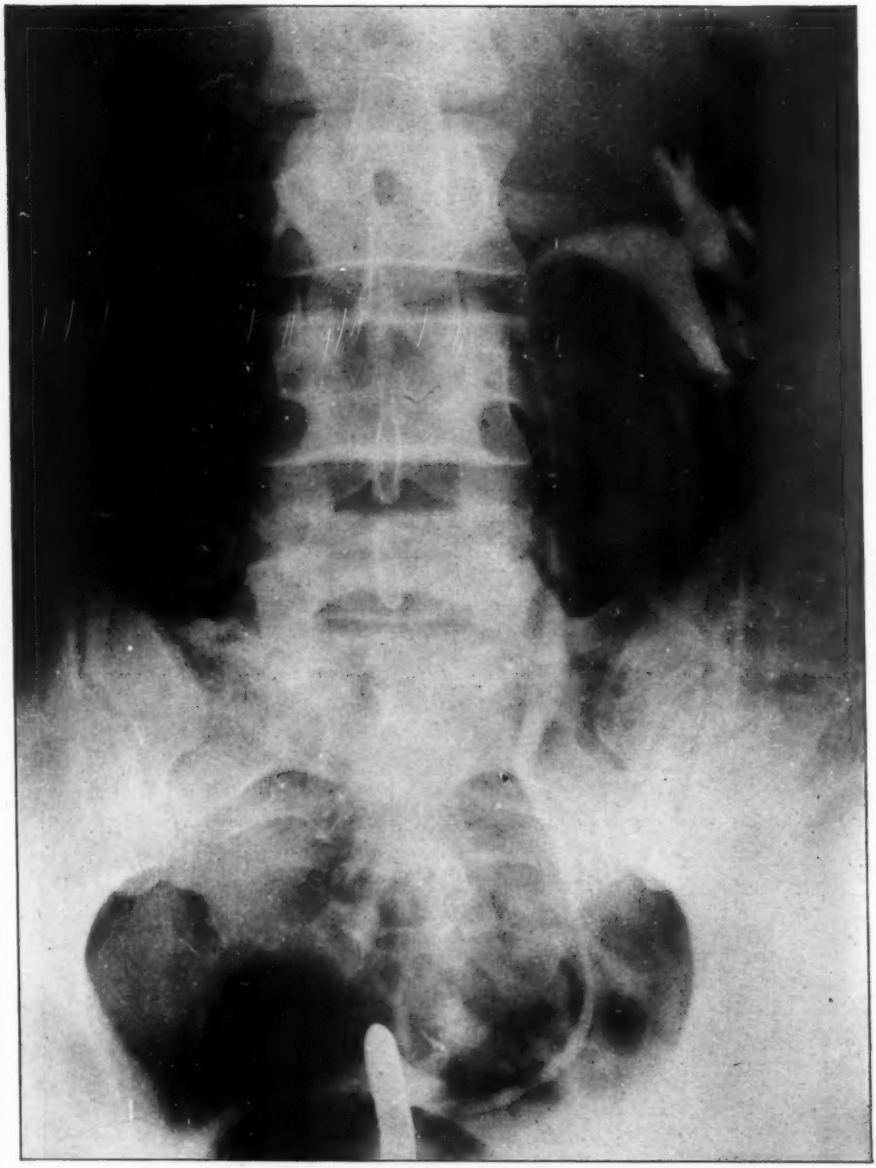


Fig. 10. X-ray No. 9679. Region: abdomen and pelvis. Colloidal silver injection outlines a carefully injected renal pelvis and ureter, with full but not over distention of either calyces, pelvis or ureter.

Fig. 11. X-ray No. 13018, a. Region: right lumbar. Original plate shows suspicious shadow in region of right kidney pelvis, also suspicious shadow opposite 5th lumbar.

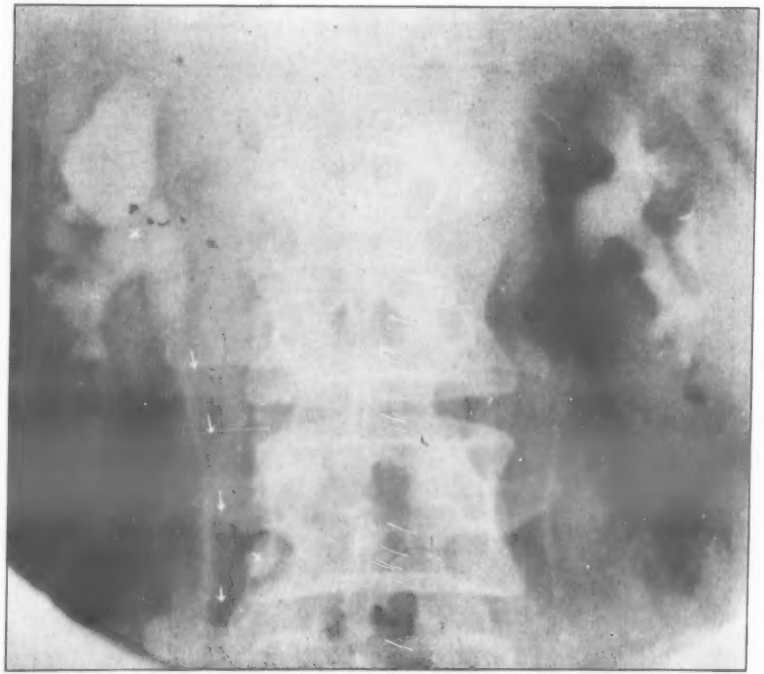


Fig. 12. X-ray No. 13018, b. Colloidal silver locates a shadow in the renal pelvis and shows distention of the upper calyx, also rules out lower shadow. Left kidney also injected and shows a normal pelvis.

Fig. 13. X-ray No. 11044, a. Region: right lumbar. Radiograph shows composite shadow at level of second intravertebral disc.

Fig. 14. X-ray No. 11044, b. Colloidal silver injection shows moderate hydronephrosis with distention of both pelves and calyces. Note outline of renal calculus in renal pelvis. Confirmed at operation.

Fig. 15. X-ray No. 13128, a. Region: right lumbar. Original plate shows two suspicious shadows. These must be studied further.

Fig. 16. X-ray No. 13128, b. Colloidal silver locates suspicious shadows; shows larger one in middle calyx, other at ureteral-pelvic junction. Small distention of the upper calyx. At operation calculus removed from ureteral-pelvic junction.

Fig. 17. X-ray No. 13159, a. Region: right lumbar. Original plate. Arrows indicate two small suspicious shadows and one much larger.

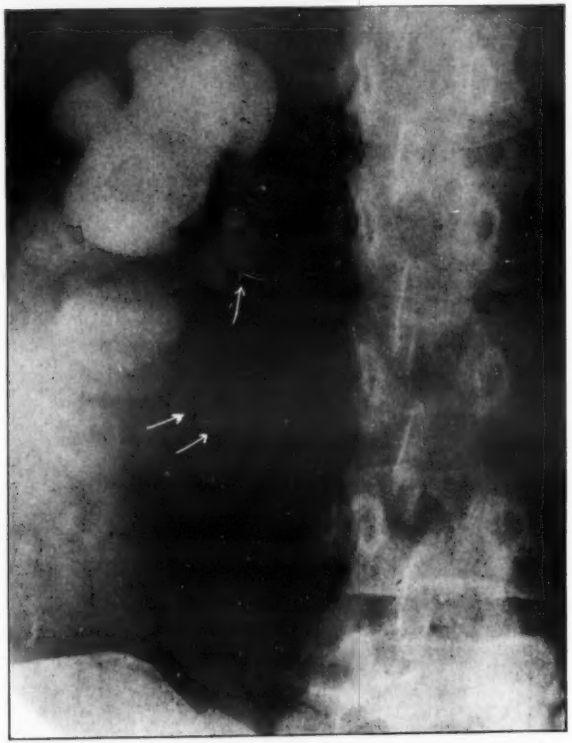


Fig. 18. X-ray No. 13159, b. Colloidal silver injection shows considerable hydronephrosis. Note change in position of large calculus, having been pushed up an inch by introduction of catheter. At operation larger calculus obstructed ureter at ureteral-pelvic junction. Two small stones removed from cortex of lower pole.

Fig. 19. X-ray No. 13167, a. Region: left lumbar. Original plate. Note outline of large branched shadow and compare with Plate b.

Fig. 20. X-ray No. 13167, b. Colloidal silver shows shadow to be a large branched stone filling kidney pelvis and calyces. No hydronephrosis or pyonephrosis is associated with it. At operation multiple stones removed from cortex and large branched stone from the pelvis. No hydronephrosis or pyonephrosis was present.

Fig. 21. X-ray No. 13447. Region: left lumbar. Colloidal silver injection shows pyonephrosis with multiple calculi in upper pole, single branched calculus in lower pole. Confirmed at operation.

Fig. 22. X-ray No. 11516, a. Region: left side of pelvis. Original plate shows a suspicious shadow at region of left ureteral-pelvic junction.

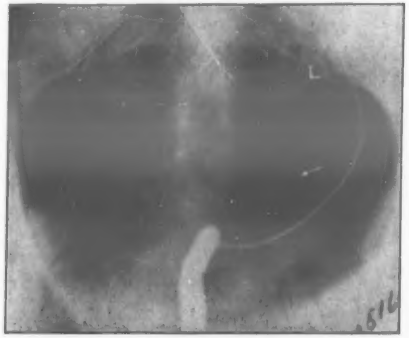


Fig. 23. X-ray No. 11516, b. Shadow of the catheter rules out possibility of the shadow being intra-ureteral. Evidence of inflammatory condition in right kidney obtained and right kidney and ureter therefore injected with colloidal silver. (See Plate c.)

Fig. 24. X-ray No. 11516, c. Both lumbar regions. Colloidal silver shows outline of a distended renal pelvis with irregular calyces, indicating a pyonephrosis. At operation a tuberculous pyelitis and a small pyonephrosis was found.

Fig. 25. X-ray No. 12826. Region: right lumbar. A calcified dead kidney. Absence of secretion. Not operated.

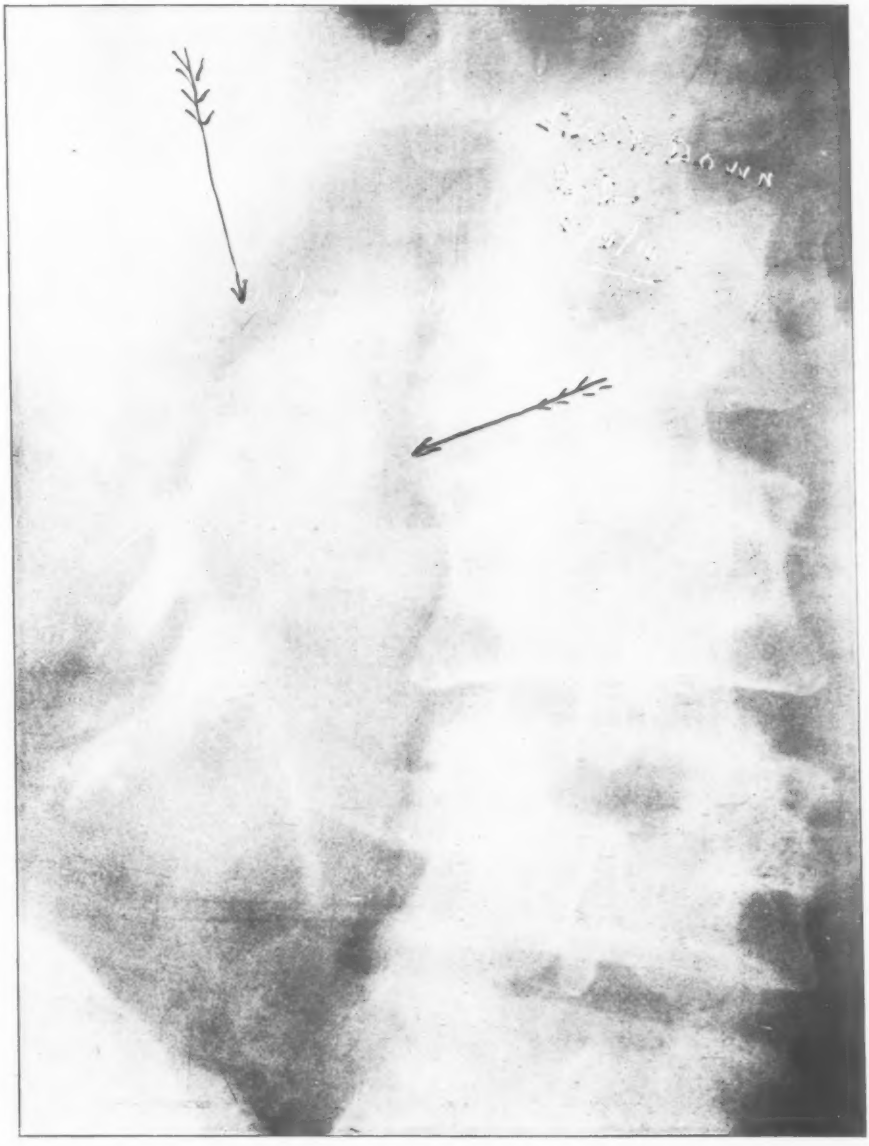


Fig. 26. X-ray No. 8517. Region: right lumbar. Colloidal silver injection of renal pelvis. Original plate showed a shadow size of a pigeon's egg over region of right renal pelvis. Arrows point to shadow overlappng renal pelvis. No evidence of obstruction or dilatation. At operation proved to be a large gall-stone covered with a deposit of lime salts.

Fig. 27. X-ray No. 10546. Region: left lumbar. Colloidal silver injection shows irregular distention of ureter throughout its length; kidney pelvis contracted, indicating an inflammatory condition. Diagnosis: tuberculosis of kidney and ureter. Confirmed at operation.

Fig. 28. X-ray No. 9304. Region: abdomen and pelvis. Uniform moderate dilatation of left ureter throughout its entire length with small hydronephrosis. Obstruction present at ureteral-vesicular junction. Shadow on original plate present at this point. Diagnosis: small ureteral stone. Not operated.

Fig. 29. X-ray No. 9076. Region: right lumbar. Colloidal silver injection outlines a normal renal pelvis in a low-lying kidney.

Fig. 30. X-ray No. 8399. Region: left lumbar. Colloidal silver injection demonstrating an enlarged renal pelvis with normal outline of calyces. No evidence of ureteral stricture or obstruction. Explored at operation for fibroids and found to be normal.

Fig. 31. X-ray No. 11082. Region: right lumbar and pelvis. Colloidal silver injection outlines distended pelvis of a low-lying kidney and a sharp kink of ureter at level of fourth transverse process with moderate hydronephrosis.

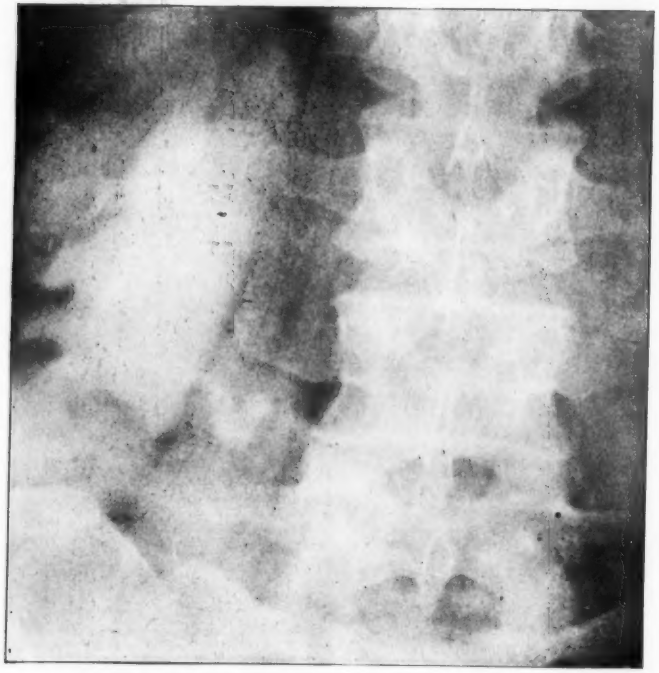


Fig. 32. X-ray No. 12674. Region: right lumbar. Intermittent hydronephrosis. Varies in size from a few ounces to size of a child's head. Note position of low-lying renal pelvis and tortuous condition of the ureter. Calyces not distended. At operation contained only three ounces.

Fig. 33. X-ray No. 13517. Region: right kidney. Colloidal silver injection shows a low-lying kidney with complete rotation of the organ on its long axis. A hydronephrosis is present. Arrows indicate position of ureter. Not operated.

Fig. 34. X-ray No. 8705, a. Region: right kidney and ureter. Original plate. There is no suggestion of the pathologic condition encountered at the cystoscopic examination. Confirmed by the combined examination and proved at operation. (See Plates b and c.)

Fig. 35. X-ray No. 8705, b. Colloidal silver injection shows a hydronephrosis with great dilatation of the ureter throughout its length. Compare with Plates a and c. Confirmed at operation. Congenital stricture of ureter at the bladder.

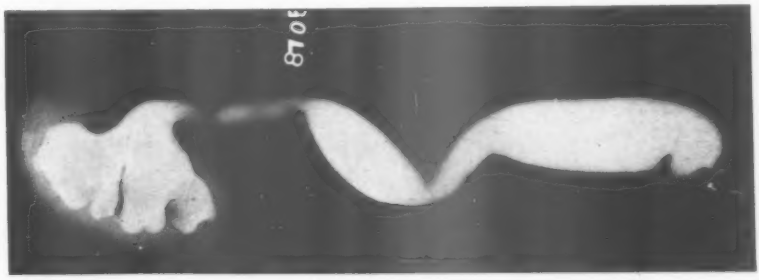


Fig. 36. X-ray No. 8705, c. Radiograph of pathologic specimen reinjected with colloidal silver immediately after operation.

Fig. 37. X-ray No. 10317. Region: left lumbar. A large hydronephrosis. A suspicious shadow in line of right ureter indicated cystocopic examination and this led to finding of the hydronephrosis. At operation an anomalous vessel was found constricting the ureter.

Fig. 38. X-ray No. 9105. Region: left lumbar. A huge pyonephrosis. Colloidal silver to be seen in scattered areas. At operation found to contain three pts. of pus.

Fig. 39. X-ray No. 10173½. Region: right lumbar. Huge hydronephrosis. Its position, outline and approximate size clearly demonstrated by colloidal silver. Note sharp bend in ureter indicated by arrow over spine. At operation found to be infected.

Fig. 40. X-ray No. 10215. Region: right lower abdomen. Colloidal silver injection of kidney and ureter. Shows a horse-shoe kidney with moderate distention of the pelvis in upper pole and great distention of the pelvis in lower pole (left pelvis). Confirmed at operation for appendicitis.

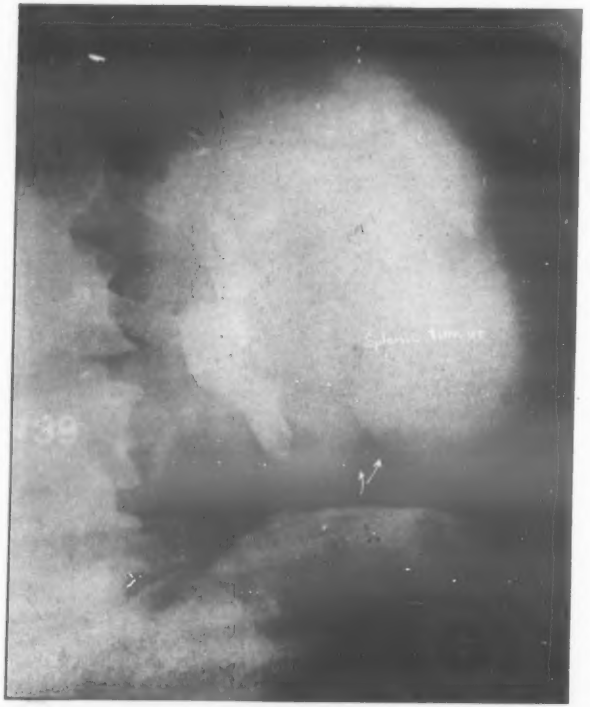


Fig. 41. X-ray No. 9139. Region: left lumbar. The presence of large tumor indicated a shadow plate of the renal pelvis to differentiate the tumor mass from kidney. Note shadow of tumor overlapping outer portion of kidney. Renal pelvis normal. At operation tumor proved to be spleen.

Fig. 42. X-ray No. 12972. Region: left lumbar Colloidal silver injection of kidney and ureter shows renal pelvis displaced in front of spine and shows distortion from pressure of large tumor mass shown to be extra-renal. At operation a large hematoma was encountered.

Fig. 43. X-ray No. 10073½. Right lumbar region. Colloidal silver injection shows renal pelvis to be constricted, its calyces either irregularly distended or elongated and narrowed. Diagnosis: mesothelioma. Confirmed at operation.

Fig. 44. X-ray No. 10962. Region: abdomen and pelvis. Colloidal silver injection of both right and left kidney and ureter; shows two separate ureters on the right leading to a kidney with double pelvis. A single ureter on the left.

ABSTRACTS

SELECTED BY F. C. ZAPFFE, M. D.

An Improvised Roentgen-Ray Apparatus.

BY HOSP. STEWARD H. A. HARRIS, U. S. N.

U. S. Naval Med. Bull., July, 1911.

The X-ray apparatus illustrated in the figure has been installed at the dispensary, navy yard, Mare Island, Cal. After more than six months' use it has been demonstrated that the apparatus is economical, practical, and now indispensable. It has been operated nearly every day during this period with complete success and is exceptionally well adapted for fluoroscopic examinations, as it requires no "tuning up." This is due to the fact that it has been possible to rectify the current without using an electrolytic rectifier. In therapeutic work it has been run 10 to 15 minutes without overheating any part.

The radiographs, for definition and sharpness, are considered excellent. The energizing system is composed of one Lodge-Muirhead 8-inch induction coil. The coil's primary is connected in series with the interrupter, inductance, and rheostat. The inductance was obtained from a discarded arc lamp and needs no further description.

It is well known that to operate an X-ray tube a current of one direction is essential; that is to say, a potential in one direction must predominate. The elementary sketch attached shows clearly the connections.

The rectifying interrupter deserves attention. It is known that the only current available in quantity at the yard dispensary is alternating, and no tube is free from transverse currents when energized with a sinusoidal current. To overcome this the elements iron and lead were placed in a 20 per cent solution of sulphuric acid in water, adding to this 3 ounces of ammonium phosphate. The glass jar containing the solution has a capacity of about one gallon.

The positive element iron—a stub steel rod about three thirty-seconds of an inch in diameter—is inserted into a tight-fitting rubber tube. This insulates all parts except the immersed end, the other end protruding above for external connection. The negative element is an ordinary lead plate.

This interrupter rectifies the A. C. current, increases the frequency and efficiency, and does away with the cumbersome chemical rectifiers now in use. The consequence is that the apparatus is very simple and therefore very reliable.

The frequency does not vary from two above to two below 120 cycles per second; therefore we may consider the frequency as constant. The current varies slightly with time, due to the deterioration of the positive element, but this variation can easily be adjusted in a few seconds. The tube glows brilliantly and a distinct division of the cathode and anode rays is seen when using a current varying between 9 and 7 amperes.

The total cost of the interrupter does not exceed $5; no element exceeds $2 in cost.

The solution has been used successfully on intermittent work for three months. The radiographic effects have been improved by the addition of a small amount of powdered alum. This modifies the peak of the wave and causes the tube to become more mellow.

Topography of the Ureter as Determined by the Shadowgraph Catheter.

BY L. E. SCHMIDT AND H. L. KRESTCHMER, CHICAGO.

Surgery, Gynecology and Obstetrics, September, 1911.

In carrying out this work the authors have employed the ordinary ureteral catheters, armed with fuse wire. In all the cases, the pictures were taken with the patients in the prone position. Judging from the work done, they believe that the shadows produced by the fuse wire are much more satisfactory than those obtained by injecting solutions of the newer silver salts, particularly for showing the course of the ureter. For the purpose of demonstrating the size, shape and position of the renal pelvis, solutions of silver salts, such as cargentos, argyrol or collargol, as a routine procedure, give far more satisfactory information than the fuse wire catheter. However, there are cases in which dilated pelves and other pathological conditions in the kidney have been diagnosed by the shadow-

graph catheter. Fenwick's mid-ilio-costal vertical line divides the loin space into an inner and an outer division. It will be found that shadows outside the mid-vertical line are usually cast by contents of the bowel; shadows inside the mid-vertical line are usually urinary shadows, or rarely cretaceous gland shadows, occasionally they may be bowel. In this series of cases, without exception, the ureter and the kidney were well within the mid-ilio-costal vertical line. In five cases, the catheters, after having entered the ureteral orifices, rather abruptly passed outward from the median line toward the lateral wall of the pelvis, forming almost a right angle with an imaginary vertical line drawn through the center of the figures. In four cases the ureters, in their outward course away from the median line, formed a more or less acute angle with the above mentioned imaginary line. In following the course of the ureters upward, they bend inward and cross the sacro-iliac synchondrosis in seven cases, while on the other hand, in three cases the ureters can be seen lying external to the sacro-iliac synchondrosis. In one case, the two ureters are more or less parallel up to a point corresponding to the anterior superior spines, from which point they diverge from the median line. The iliac spines were marked by connecting them with fuse wire, which is shown in the pictures as a transverse line. In the same manner the position of the umbilicus was marked. Here the course of the two ureters is more or less parallel up to the level of the umbilicus, at which point the left ureter passes upward to the usual position of the kidney, whereas the right ureter stops just above the level of the umbilicus. Besides the difference in height the same picture shows a difference in the course of the ureters; on the right side the ureter, after crossing the sacro-iliac synchondrosis, passes upward and outward, and at its termination passes outward and away from the median line; on the left side the course of the ureter is steadily upward and inward toward the median line, so that at its termination it lies at the junction of the transverse process with the body of the vertebra. At its upper end the catheter has a general tendency to pass away from the median line in four cases. An S-shaped course is seen in the ureter in one case, while in two others it shows a serpentine course. Another

case shows the two ureters very far apart throughout their entire course; at no time do they show any tendency to approach each other. In another case the difference in the course of the two ureters can be seen both above and below the umbilicus. At its termination above the umbilicus the left ureter passes upward, outward and then inward toward the median line, whereas the right ureter passes upward almost in a vertical direction. The authors recognize the possibility that the shadowgraph bougie may produce irregularities in and distortions of the course of the ureter. They have found that the fuse wire, because of its pliability, gives rise to less errors of this type than any other material.

Roentgentherapy of Ringworm.

BY J. HALL-EDWARDS.

British Medical Journal, Oct. 14, 1911.

In considering the various methods of treatment of ringworm now usually adopted, Hall-Edwards says there can be no doubt that the Roentgen rays have a large balance in their favor. When the treatment is efficiently and carefully carried out a cure can be secured in from six to eight weeks, as against twenty-seven months, which was the average as calculated by Sabouraud. The actual time occupied in treatment is shortened. The results of the treatment are certain. Reinfection can be more easily guarded against. Epilation comes about without any interference on the part of the parents, hence the neglect to carry out instructions is a matter of comparatively small importance. The treatment is free from danger. No case of permanent injury has been reported out of the hundreds of thousands that have been treated. Hall-Edwards has seen no ill effects produced other than those which have arisen from faulty technic, and these have, in every instance, been due to negligence or want of knowledge of the apparatus and its power. With the best apparatus now obtainable, epilation can be produced with ease and certainty. Cases have been recorded where the hair has failed to re-appear after a dose which could in no way be considered excessive. It must not, however, be forgotten that permanent

baldness sometimes occurs after the ordinary methods of treatment have been used. Hall-Edwards doubts very much whether this condition is any more common after Roentgen ray treatment than it is after epilation brought about by other methods. In choosing apparatus for radio-therapy, it is of paramount importance that the group should be so arranged that the output of radiations shall be constant both in intensity and quality. Hall-Edwards prefers to use a coil of the non-intensified variety having a spark length of from 10 to 12 inches, provided with a break capable of giving constant and unvarying interruptions. The mercury-dipper break is the only one which, as far as he knows, will comply with these conditions, and then only when it is not run too fast. The break should have a tachymeter attached, and be provided with an automatic cut-out. A milliamperemeter and spark-gap (or some other arrangement for rendering the current undirectional) should be placed in the secondary circuit. The tube holder should be one which can be fixed in any desired position with ease, which protects the patient from indirect rays, which is provided with an arrangement for holding the Sabouraud pastille, and with attachment for holding adapters. It should be placed inside a lead-lined cubicle, and the remainder of the apparatus should so be arranged that it can be manipulated from without, the patient being watched through a rayproof lead-glass window. A point on which Hall-Edwards lays some stress is summed up in the question: Is there a difference—and if so what is it precisely—between the production of epilation in two minutes and in a quarter of an hour? Taking it for granted that the dose in each case is accurately measured, he thinks that there is a distinct difference. His own preference is to occupy five minutes at least in producing epilation. Another point to which he draws attention is this: If the operation is to be successful, one must not be too careful about the amount of hair that may be taken off. So long as the hair has to come off at all, what does it matter whether we take it off a considerable area, so as to allow an ample margin, or confine it rigidly to a small circle?

Roentgentherapy of Malignant Disease.

BY REGINALD MORTON.

The author uses an "elderly" and well-seasoned tube having a water-cooled anticathode and a resistance equivalent to a 5-in. spark-gap or thereabouts. The distance from the anticathode to the skin is 9 in., and over the latter are placed two layers of the tungstated lint. The current through the tube varies from 1.5 to 20.0 ma., time of exposure ten to fifteen minutes, and this is repeated three times a week so long as the condition of the superficial tissues permits. Under these conditions he carries on treatment almost indefinitely, just keeping short of any active dermatitis. The relief of pain is, as a rule, very prompt, and provided the case is one that is amenable to this form of treatment, he gets the best results. The Roentgen rays have a definite inhibitory action on the growth of all cellular, living animal tissues when applied strongly and for a sufficient length of time, and under favorable conditions will bring about their destruction and removal; this does not take place to any appreciable extent after the rays have traversed a certain thickness of tissue, which is about half an inch. Cancerous and other diseased cells, having a lower vitality than normal cells, are more easily destroyed than the latter, and we can affect them at a greater depth. Morton does not believe in what some enthusiasts are pleased to refer to as "selective action." He says that the lower vitality of the diseased cell is ample to account for what takes place, and there is no need to strain our imaginations in the effort to attribute to a purely physical force a faculty more or less confined to sentient beings. The prospect of bringing about a definitely favorable influence on any particular case, he thinks, is very much a question of the thickness of the growth. If more than half an inch and advancing, Roentgen ray treatment is not likely to do very much good. It is the difficulty of efficiently acting on the advancing margin of a malignant growth that prevents our efforts being more successful than they are. The small lymphoid nodules so frequently found near the scar following an operation for cancer can be made to disappear very rapidly as a rule. The relief of pain, when present, is one of the most constant and satisfactory features

about this method, and we can claim in addition that the great majority of the cases that come to us are definitely improved, locally and generally, for a time at least. In the present unsatisfactory state of our knowledge regarding the real nature and cure of malignant disease, these considerations amply justify the employment of the method to an even greater extent than it is employed at present. Postoperative Roentgen ray treatment is not so general as it should be, and, in addition, there is a tendency to wait too long before instituting it, even until there are definite signs of recurrence, which is not the best time. In operable cases, Morton considers that the site of the growth should receive a full dose of Roentgen rays before the wound is closed, the latter being held as wide open as possible. With modern apparatus this can be given in five minutes, if necessary, and there is no serious objection to this being done. This should do much to destroy any stray cancer cells that have escaped removal, and thus diminish the percentage of recurrences. As soon as the patient can bear it, postoperative treatment should be commenced, and at least twelve applications given on alternate days. After a month or six weeks a second course should be given, to be followed by a third after a second interval of two or three months. One of the weakest points about the treatment of malignant disease by the Roentgen ray or any other form of radiation is that it gives no control over metastasis. It is the object of the procedure he advised to make some effort to deal with this contingency. Morton wants surgeons to adopt postoperative Roentgen ray treatment in all cases as a matter of routine and see that it is done thoroughly; in cases deemed inoperable, he says, we want them to clear the ground for us, when circumstances permit, so as to give the method, and the patient, every possible chance. A full dose of the Roentgen rays should be applied to the open wound at every operation for the removal of a malignant growth.

Treatment of Certain Diseases of the Alimentary Tract by Roentgen Rays Combined with the Internal Administration of Metallic Silver.
BY F. HERNAMAN-JOHNSON.

Thomson's statement that silver emits rays which, as regards absorption by animal tissues, were practically identical with the

beta radiation of radium, lead Hernaman-Johnson to the conclusion that if silver, in a suitable form, could be introduced into the alimentary tract and made to cover an area of ulceration, the result of exciting the metal by hard Roentgen rays projected through the back of the ulcer would be a bombardment of the diseased surface similar in effect to that from a highly active radium salt. For the purpose in view an insoluble, finely divided preparation of silver was essential. He obtained some of the metal in a chemically pure precipitated form. Silver so prepared is a dark amorphous-looking powder, gritty in the mouth, but tasteless. He experimented on himself for a fortnight, taking quantities up to 8 grams (about a quarter of an ounce) per day. As no evil result followed he felt justified in giving it to his patients. The first case was one of suspected duodenal ulcer. The second patient suffered from disease of the colon. A careful consideration of the history and symptoms of the latter patient left no doubt that there existed chronic ulceration of the large bowel, with accompanying general toxemia. As the patient would not consent to see a surgeon, and as ordinary medical treatment was without effect, Hernaman-Johnson decided to try Roentgen rays. It was therefore necessary in this case to administer a preliminary bismuth meal, followed by a screen examination. This showed that food reached the cecum in five hours, and was delayed twenty-four to thirty hours in the ascending colon. Treatment was therefore commenced as follows: At 9 a. m., a "silver breakfast" was given, consisting of a pint of milk, with enough bread-crumbs to make a moderately stiff paste; about 8 grams of precipitated silver being intimately mixed with the whole. At 4 p. m. (seven hours later) an exposure was made, the conditions being these: A self-regulating tube (Müller pattern) was placed above the region of the cecum, the anticathode being 25 cm. (about 10 in.) from the skin. A current of 0.4 milliampere was passed for ten minutes, the penetration number of the tube under these conditions being 8 to 9 Wehnelt. An interval of five minutes for cooling was allowed at half time, and the milliampere readings remained practically constant throughout the sitting. An area of skin 7 in. (about 17 cm.) in diameter was left unscreened, and no

filters were used. The anodal end of the tube was raised somewhat, so that its long axis made an angle of about 20 degrees with the surface of the body. The exact position of the ulceration could not, of course, be defined, and the bulb was therefore placed alternately above and below the patient. This procedure was repeated three times a week for four weeks. At the end of this time the constipation had considerably improved, headache was lessened, and the patient could bear more pressure over the affected portion of the gut. Hernaman-Johnson continued treatment for another two months, but reduced the number of sittings to two per week. Meanwhile, a gradual improvement took place, and the patient finally returned to work, having received in all thirty applications. He professed himself completely cured. No tenderness or rigidity remained in the abdomen, a painless action of the bowels took place every day, and ordinary food could be eaten without ill effect. No relapse has occurred up to the present, four months after the cessation of treatment. Hernaman-Johnson treated in all seven cases by the above method —one somewhat similar to the above, but with symptoms pointing to the ascending colon; three of suspected duodenal ulcer; one of gastric ulcer; and one of pyloric obstruction with tumor, possibly malignant. Of the series four are apparently cured; one, a duodenal ulcer, failed to show any improvement; the remaining two are still under treatment. The gastric ulcer patient ceased to attend as soon as her pain disappeared, which was in about three weeks. She has returned with a relapse. The pyloric tumor seems to be diminishing in size; there is less vomiting, and the patient feels much more comfortable.

Differences in the Appearances of Phthisical Chests as Shown Before and After Treatment.

BY W. BERNARD KNOBEL.

The use of Roentgen rays in phthisis, says Knobel, is to add to and corroborate the signs obtained physically. If one examines a case of what is called active phthisis with the fluorescent screen certain signs indicative of the disease may be observed. There may be on one side: 1. Limitation of the

movement of the diaphragm. 2. Uneven movement of the diaphragm. 3. Alteration in the curve of the ribs with narrowing of the intercostal spaces. 4. Impaired translucency of an apex. 5. Definite shadow or shadows. The most infrequent sign, Knobel thinks, is uneven movement of the diaphragm. When this is present it is generally associated with cogwheel breathing, and it certainly seems as if one was the cause of the other; at the same time Knobel has found uneven diaphragmatic movement without cogwheel breathing, and vice versa. Limitation in movement of one side of the diaphragm is a frequent but not a constant sign. It is often well marked in quite early cases. Knobel has observed in many early cases drooping of the ribs on the affected side where there is no spinal curvature or other condition to account for it. Although not always present, especially in cases associated with emphysema, yet it is so frequent a sign that he regards it as an early sign of considerable importance. The one Roentgen ray sign which Knobel has always found to be present in cases of active phthisis is impaired translucency of an apex. It is observed in cases where no shadow is apparent on screen or plate. In a case where there was a definite shadow near the root of the lung and no shadow at the apex there was poor illumination of the apex, but very fair illumination of the rest of the lung. In some cases not only is there deficient illumination of the apex, but the whole of that lung does not light up as well on inspiration as the other side. Apart from shadows, the Roentgen ray signs of phthisis are all signs which are independent of the local tuberculous lesion. They are not directly caused by the lesion, but are signs of impaired function and the necessary consequence of increased airlessness of the lung which would particularly affect the apex. Therefore deficient illumination by the Roentgen rays is the most constant, and therefore the most important, sign of active phthisis. Moreover, when one is equally experienced with the fluorescent screen and the physical examination, it is easier to detect differences between the two sides by seeing than it is by hearing. Knobel finds that the charm of a screen examination in phthisis is that one is able to separate the signs due to the actual lesion, that is, the shadows, from those due to loss of function. One is

able to see the lung working, and to compare one side with the other. With a physical examination one is not altogether able to determine the cause of all the signs. In his experience, the most marked change in the signs as the result of treatment is in the illumination of the apex, and perhaps the whole lung, by Roentgen rays. In cases where a definite shadow is present at the apex with poor illumination before treatment, at the end of the treatment the shadow is still there but with much better illumination around it. Even in much more advanced cases with considerable shadowing, with improvement in symptoms and general signs, there is improvement in the illumination of the portions of the lung not covered in shadow. The presence of a small shadow is by itself of no value whatsoever in the diagnosis of phthisis. If a shadow is present before treatment, it will be present after treatment when the patient is cured. It may be somewhat altered, but it will still be a definite shadow. If one examines a radiograph of a chest which shows a shadow in the lung, except in the case of certain comparatively rare conditions, one can definitely say that the patient of whom the radiograph was taken has or has had phthisis. But one could not possibly say what condition that patient was in as regards immunity to tuberculous infection. One could not say whether the plate had been taken before or after treatment. In the ordinary length of time—three to six months—in which one can "cure" moderately early cases of phthisis, Knobel has not seen much change in the shadows. After a longer time he has seen shadows get less opaque or more diffuse. In one case a patch of consolidation has largely disappeared after fifteen months' treatment. In more advanced cases one sees dense shadows become lighter in parts from the formation of cavities, and the walls of cavities become denser after treatment. The great value of radiographs in phthisis is to give one an accurate picture of the extent of the disease that is capable of casting a shadow. Every other sign of phthisis is better observed on the screen. Two radiographs taken of the same patient before and after, say, three or six months' treatment, may show slight differences in the shadows, and any alteration in the slope of the ribs, but it is not easy to show dif-

ferences in illumination. The deficient illumination of an apex, which may be quite apparent on the screen, is often not shown on the plate owing to the more penetrative rays used for photographic purposes and the length of exposure. And, further, any alteration in the movements of the diaphragm can, of course, only be observed on the screen. For these reasons, Knobel thinks the most valuable method of using Roentgen rays for the diagnosis of phthisis and for determining the results of treatment is examination with the fluorescent screen.

ANNUAL MEETING, WESTERN SECTION

The annual meeting of the Western Section of the American Roentgen Ray Society was held Feb. 22, 1912, in the Flemish room of the Hotel Cadillac, Detroit, Mich.

On account of the severe storm which swept over the entire country, many were undoubtedly prevented from coming, but among those who braved the terrors of late trains were Dr. Arial George of Boston, Drs. Holding and Le Wald of New York, Drs. Lange and Dunham of Cincinnati, Dr. Bowen of Columbus, Dr. Reu of Buffalo, Dr. Selby of Rochester, Minn., Mr. Dachtler of Toledo, and Dr. Hill of Cleveland.

The afternoon session was devoted to the demonstration of plates and lantern slides. Each member furnished his proper quota of slides and a very free and aggressive discussion on the plates.

Among the topics discussed were roentgrams of cardiospasms, abscess of the lungs, mobile cecum and many questions incident to the gastro-intestinal tract.

The unanimous opinion of those who were present was that the meeting was very fruitful of results and all felt amply repaid for their expenditure of time. As only a comparatively limited number were present, a warm and spirited discussion took place which was very productive of a free exchange of ideas.

Vol. III *April 1911* No. 1

MAY 7 1912

The American Quarterly of Roentgenology

PUBLISHED BY

The American Roentgen Ray Society

Edited by P. M. Hickey, M. D.

	Page
X-Ray Therapy of Enlarged Thymus - - *By Sidney Lange, M. D.*	1
Detection of Gallstones by the Roentgen Ray - - *By George E. Pfahler, M. D.*	23
Photography of the Fluorescent Screen for Roentgen Kinematography and Other Purposes - - - *By E. W. Caldwell, M. D.*	34
Description of Method of Measuring Female Pelvis - - *By W. F. Manges, M. D.*	41
Further Contributions on the X-Ray Treatment of Leukemia - *By Henry K. Pancoast, M. D.*	44
The Roentgen Treatment of Carcinoma of the Breast - *By Russell H. Boggs, M. D.*	53
Therapeutic Efficiency of Roentgen Irradiation - - *By Geo. C. Johnston, M. D.*	62
Roentgen Ray Therapy and Its Practical Application in Malignant Lesions - - - - - *By J. Rudis-Jicinsky, M. D.*	68
A New Localizer - - - - - -	89
Editorial - - - - - -	92
Abstracts from English Literature - - - -	95

COPYRIGHT APPLIED FOR BY PRESTON M. HICKEY. ALL RIGHTS RESERVED.

Published Quarterly. Subscription, Five Dollars a Year, Postpaid

Officers of
American Roentgen Ray Society

PRESIDENT: PERCY BROWN, M. D.
Boston, Mass.

VICE-PRESIDENTS:

W. C. HILL, M. D., Cleveland, Ohio
EDWARD H. SKINNER, M. D., Kansas City, Mo.
W. F. MANGES, M. D., Philadelphia, Pa.

SECRETARY: F. H. BAETJER, M. D.
Baltimore, Md.

TREASURER: CHAS. F. BOWEN, M. D.
Columbus, Ohio

Executive Committee

HENRY K. PANCOAST, M. D., University Hosp., Philadelphia, Pa.
ARTHUR HOLDING, M. D., Albany, N. Y.
P. M. HICKEY, M. D., 32 Adams Ave. West, Detroit, Mich.

Committee on Publication

P. M HICKEY, M. D., Detroit, Mich.
SIDNEY LANGE, M. D., Cincinnati, Ohio
D. R. BOWEN, M. D., Rome, New York

The Interrupterless

X-RAY

Current Generator

Patented

It is the only Current Generator to operate with equal results from the direct or alternating currents three hundred and sixty-five days in the year.

Have you our large Catalogue descriptive of X-Ray Apparatus and Accessories? IF NOT, WRITE TO-DAY FOR YOUR COPY.

MANUFACTURERS

THE KNY-SCHEERER CO.

404-410 West 27th Street, NEW YORK

Vol. III *July, 1911* *No. 2*

MAY 7 1912

The American Quarterly of Roentgenology

PUBLISHED BY

The American Roentgen Ray Society

Edited by P. M. Hickey, M. D.

#273

	Page
Tuberculosis of the Lungs as Seen and Heard *By Henry Hulst, M. D.*	99
Technique and Reading of Stereo-Chest Plates *By Kennon Dunham, M. D.*	110
Chronic Joint Disease from a Roentgenologic Standpoint *By Roland Hammond, M. D.*	124
The Radiographer's Property Right in the Radiogram *By G. H. Stover, M. D.*	131
Physics and Optics of Steroscopic Roentgenography *By H. Clyde Snook, B. Sc.*	137
Case of Prostatic Hypertrophy *By Sinclair Tousey, A. M., M. D.*	143
Primary Lymphangeio-Sarcoma of the Lungs *By A. L. Gray, M. D.*	145
Observations of Cases of Constipation and Obstipation *By Arthur Holding, M. D.*	148
Editorial	152
Abstracts	153

COPYRIGHT APPLIED FOR BY PRESTON M. HICKEY. ALL RIGHTS RESERVED.

Published Quarterly. Subscription, Five Dollars a Year, Postpaid

Officers of
American Roentgen Ray Society

PRESIDENT: PERCY BROWN, M. D.
Boston, Mass.

VICE-PRESIDENTS:
W. C. HILL, M. D., Cleveland, Ohio
EDWARD H. SKINNER, M. D., Kansas City, Mo.
W. F. MANGES, M. D., Philadelphia, Pa.

SECRETARY: F. H. BAETJER, M. D.
Baltimore, Md.

TREASURER: CHAS. F. BOWEN, M. D.
Columbus, Ohio

Executive Committee

HENRY K. PANCOAST, M. D., University Hosp., Philadelphia, Pa.
ARTHUR HOLDING, M. D., Albany, N. Y.
P. M. HICKEY, M. D., 32 Adams Ave. West, Detroit, Mich.

Committee on Publication

P. M. HICKEY, M. D., Detroit, Mich.
SIDNEY LANGE, M. D., Cincinnati, Ohio
D. R. BOWEN, M. D., Philadelphia, Pa.

The Interrupterless

X-RAY

Current Generator

Patented

It is the only Current Generator to operate with equal results from the direct or alternating currents three hundred and sixty-five days in the year.

Have you our large Catalogue descriptive of X-Ray Apparatus and Accessories? IF NOT, WRITE TO-DAY FOR YOUR COPY.

MANUFACTURERS

THE KNY-SCHEERER CO.

404-410 West 27th Street, NEW YORK

Vol. III *December, 1911* *No. 3*

MAY 7 1912

The American Quarterly of Roentgenology

PUBLISHED BY

The American Roentgen Ray Society

Edited by P. M. Hickey, M. D.

4273

	Page
Fluoroscopy of the Gastro-Intestinal Tract - - - *By E. H. Skinner, M. D.*	161
Value of the X-Ray in Early Diagnosis of Carcinoma of the Bowel - - - - - - - - - *By Dr. Fedor Haenisch*	175
X-Ray Findings in Gastric and Duodenal Ulcer - - *By Howard Elmer Ashbury, M. D.*	181
The Universal Hand Stereoscope - - - - - *By H. Threlkeld-Edwards, M. D.*	191
The Bromide Paper Screen Technique - - - - *By Lewis Gregory Cole, M. D.*	200
Artificial Dilation of the Duodenum for Radiographic Examination - - - - - - - - - - *By Lewis Gregory Cole, M. D.*	204
Minutes of Twelfth Annual Meeting - - - -	206
Abstracts - - - - - - - - - -	219

COPYRIGHT APPLIED FOR BY PRESTON M. HICKEY. ALL RIGHTS RESERVED.

Published Quarterly. Subscription, Five Dollars a Year, Postpaid

Officers of
American Roentgen Ray Society

PRESIDENT: F. H. BAETJER, M. D.
Baltimore, Md.

VICE-PRESIDENTS:

G. M. STEELE, M. D., Oshkosh, Wis.
H. W. VAN ALLEN, M. D., Springfield, Mass.
J. H. EDMONSON, M. D., Birmingham, Ala.
W. H. EAGAR, M. D., Halifax, N. S.
H. E. POTTER, M. D., Chicago, Ill.

SECRETARY: HENRY K. PANCOAST, M. D.
Philadelphia, Pa.

TREASURER: CHAS. F. BOWEN, M. D.
Columbus, Ohio

Executive Committee

P. M. HICKEY, M. D., Detroit, Mich.
ARTHUR HOLDING, M. D., Albany, N. Y.
A. L. GRAY, M. D., Richmond, Va.

Committee on Publication

P. M. HICKEY, M. D., Detroit, Mich.
SIDNEY LANGE, M. D., Cincinnati, Ohio
D. R. BOWEN, M. D., Philadelphia, Pa.

Librarian

H. W. DACHTLER, Toledo, Ohio

Exact Dosage in X-Ray Treatments
is Possible if You Employ

Holzknecht Radiometer

The latest pattern with SABORAUD PASTILLES
is now stocked in New York. **Price $35.00**

The Sinegran

Intensifying Screen

is a self paying investment. It saves your time, for when used only *one quarter to one tenth* the exposure is required. And, there is *absolutely no mottling* of the negatives. Its use lengthens the tube life wonderfully.

Sizes 8" x 10" to 14" x 17" are now in stock.

Prices from $25.00 to $69.00

Use

Schleussner X-Ray Plates

if perfect results with Intensifying Screens are desired.

They are made specially for this purpose.

Schleussner X-Ray Plates are *very rapid* but *do not fog* during development.

Sizes 8" x 10" and 10" x 12" are now stocked in New York—all other sizes imported to order.

SPECIAL OFFER

Precision X-Ray Milliampere Meter without mounting **$16.00.** With wall bracket, complete **$18.75**

Delivered prepaid if cash accompanies the order.

The Kny-Scheerer Co.

ELECTRO-MEDICAL DEPARTMENT

404-410 West 27th St. NEW YORK

Vol. III *March, 1912* *No. 4*

JUN 28 1912

The American Quarterly of Roentgenology

PUBLISHED BY

The American Roentgen Ray Society

Edited by P. M. Hickey, M. D.

Associate Editor, F. C. Zapffe, M. D.

Gastric Motor Phenomena - - - - - - - - 1
By Lewis Gregory Cole, M. D.

Apparatus for Moving Pictures of the Stomach - - - 13
By Lewis Gregory Cole, M. D.

Variability of the Focus Point of the X-Ray Tube - - 15
By George E. Pfahler, M. D.

Compensating Displacements of the Thoracic Viscera - - 32
By Charles Lester Leonard, A. M., M. D.

Collaboration Essential in the Diagnosis of Surgical Conditions of the Kidney and Ureter - - - - - 42
By John Hunter Selby

Abstracts - - - - - - - - - - 51

Annual Meeting, Western Section - - - - - 62

The next Annual Meeting will be at Niagara Falls, September 11, 12, 13 and 14, 1912

COPYRIGHT APPLIED FOR BY PRESTON M. HICKEY. ALL RIGHTS RESERVED.

Published Quarterly. Subscription, Five Dollars a Year, Postpaid

Officers of
American Roentgen Ray Society

PRESIDENT: F. H. BAETJER, M. D.
Baltimore, Md.

VICE-PRESIDENTS:

G. M. STEELE, M. D., Oshkosh, Wis.
H. W. VAN ALLEN, M. D., Springfield, Mass.
J. H. EDMONSON, M. D., Birmingham, Ala.
W. H. EAGAR, M. D., Halifax, N. S.
H. E. POTTER, M. D., Chicago, Ill.

SECRETARY: HENRY K. PANCOAST, M. D.
Philadelphia, Pa.

TREASURER: CHAS. F. BOWEN, M. D.
Columbus, Ohio

Executive Committee

P. M. HICKEY, M. D., Detroit, Mich.
ARTHUR HOLDING, M. D., Albany, N. Y.
A. L. GRAY, M. D., Richmond, Va.

Committee on Publication

P. M. HICKEY, M. D., Detroit, Mich.
SIDNEY LANGE, M. D., Cincinnati, Ohio
D. R. BOWEN, M. D., Philadelphia, Pa.

Librarian

H. W. DACHTLER, Toledo, Ohio

Exact Dosage in X-Ray Treatments
is Possible if You Employ

Holzknecht Radiometer

The latest pattern with SABORAUD PASTILLES
is now stocked in New York. **Price $35.00**

The Sinegran
Intensifying Screen

is a self paying investment. It saves your time, for when used only *one quarter to one tenth* the exposure is required. And, there is *absolutely no mottling* of the negatives. Its use lengthens the tube life wonderfully.

Sizes 8" x 10" to 14" x 17" are now in stock.

Prices from $25.00 to $69.00

Use
Schleussner X-Ray Plates

if perfect results with Intensifying Screens are desired.

They are made specially for this purpose.

Schleussner X-Ray Plates are *very rapid* but *do not fog* during development.

Sizes 8" x 10" and 10" x 12" are now stocked in New York—all other sizes imported to order.

SPECIAL OFFER

Precision X-Ray Milliampere Meter without mounting **$16.00.** With wall bracket, complete **$18.75**

Delivered prepaid if cash accompanies the order.

The Kny-Scheerer Co.

ELECTRO-MEDICAL DEPARTMENT

404-410 West 27th St. NEW YORK